Section C

Infrastructure & Operation

SECTION C: INFRASTRUCTURE & OPERATION

Advice on completing this section is provided in the accompanying Guidance Note.

C.1 Operational Information Requirements

Provide a description of the plant, process and design capacity for the areas of the waste water works where discharges occur, to include a copy of such plans, drawings or maps, (site plans and location maps, process flow diagrams), and such other particulars, reports and supporting documentation as are necessary to describe all aspects of the area of the waste water works discharging to the aquatic environment. Maps and drawings must be no larger than A3 size.

Attachment C.1 should contain supporting documentation with regard to the plant and process capacity, systems, storm water overflows, emergency overflows, etc., including flow diagrams of each with any relevant additional information. These drawings / maps should also be provided as geo-referenced digital drawing files (e.g. ESRI Shapefile, MapInfo Tab, AutoCAD or other upon agreement) in Irish National Grid Projection. This data should be provided to the Agency on a separate CD-Rom containing sections B.1, B.2, B.3, B.4, B.5, D.2, E.3 and F.2.

Attachment included	Yes	No
	✓	

C.2 Outfall Design and Construction

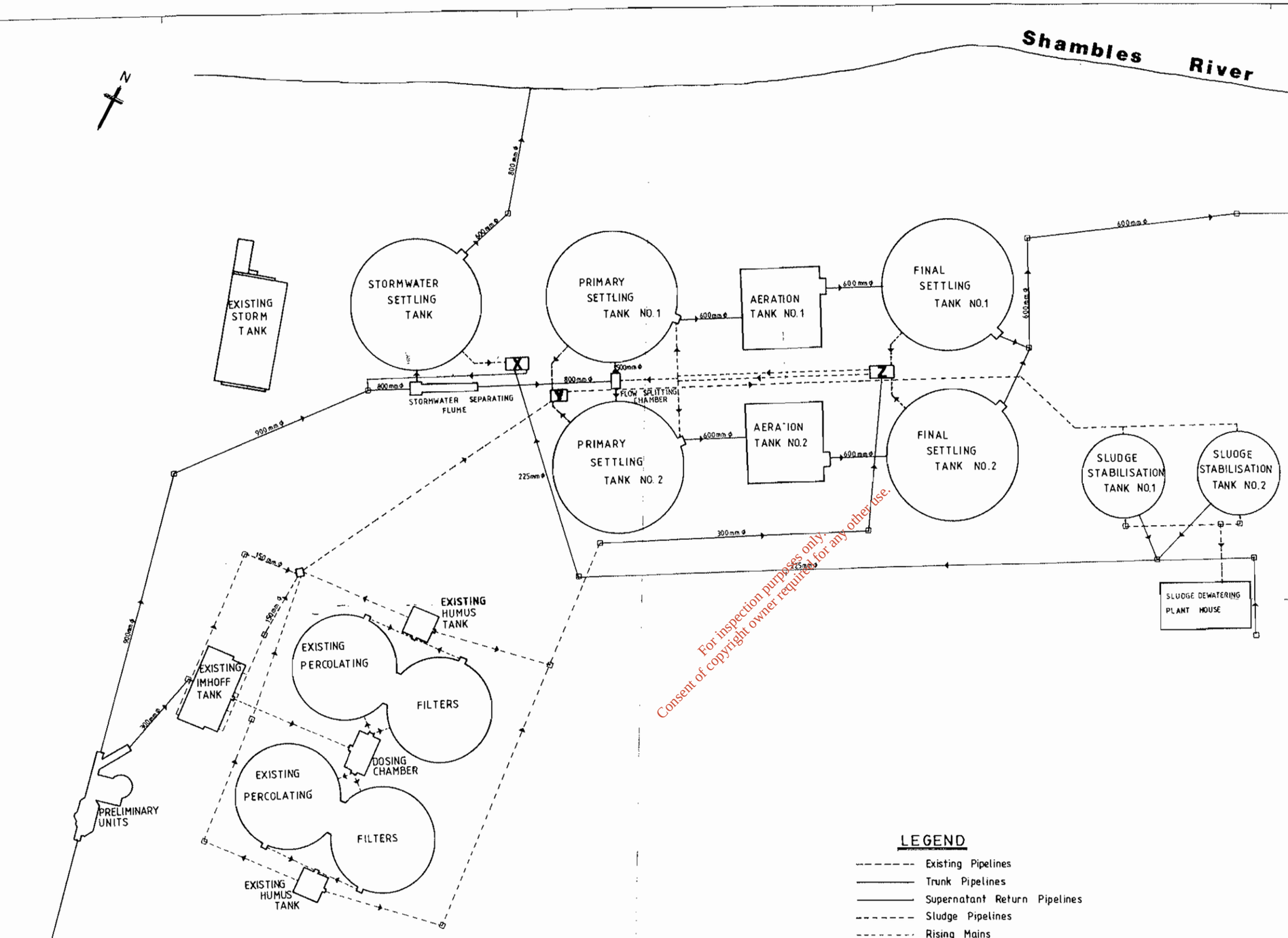
Provide details on the primary discharge point & secondary discharge points and storm overflows to include reference, location, design criteria and construction detail.

Attachment C.2 should contain any supporting documentation on the design and construction of any and all discharge outfalls, including stormwater overflows, from the waste water works.

Attachment included	Yes	No
	✓	

Attachment No. C.1

Documentation with regard to the plant and process capacity, systems, storm water overflows, emergency overflows, etc., including flow diagrams of each with any relevant additional information.



LEGEND

- Existing Pipelines
- Trunk Pipelines
- Supernatant Return Pipelines
- Sludge Pipelines
- Rising Mains
- X Stormwater Return Pump Sump
- Y Surplus Sludge Pump Sump
- Z Sludge Return Pump Sump

NOTES

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED BY THE CONTRACTOR OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES.

SUFFIX	REVISION	DATE	INI.

Monaghan Urban District Council

Monaghan Waste Water Disposal Works

Schematic Layout of Treatment Works

SCALES
1 / 500

DRAWN BY	CHECKED BY	DATE
T. M.	P. J. F.	10 / 3 / 88

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DRAWING NO. 033015 / 24

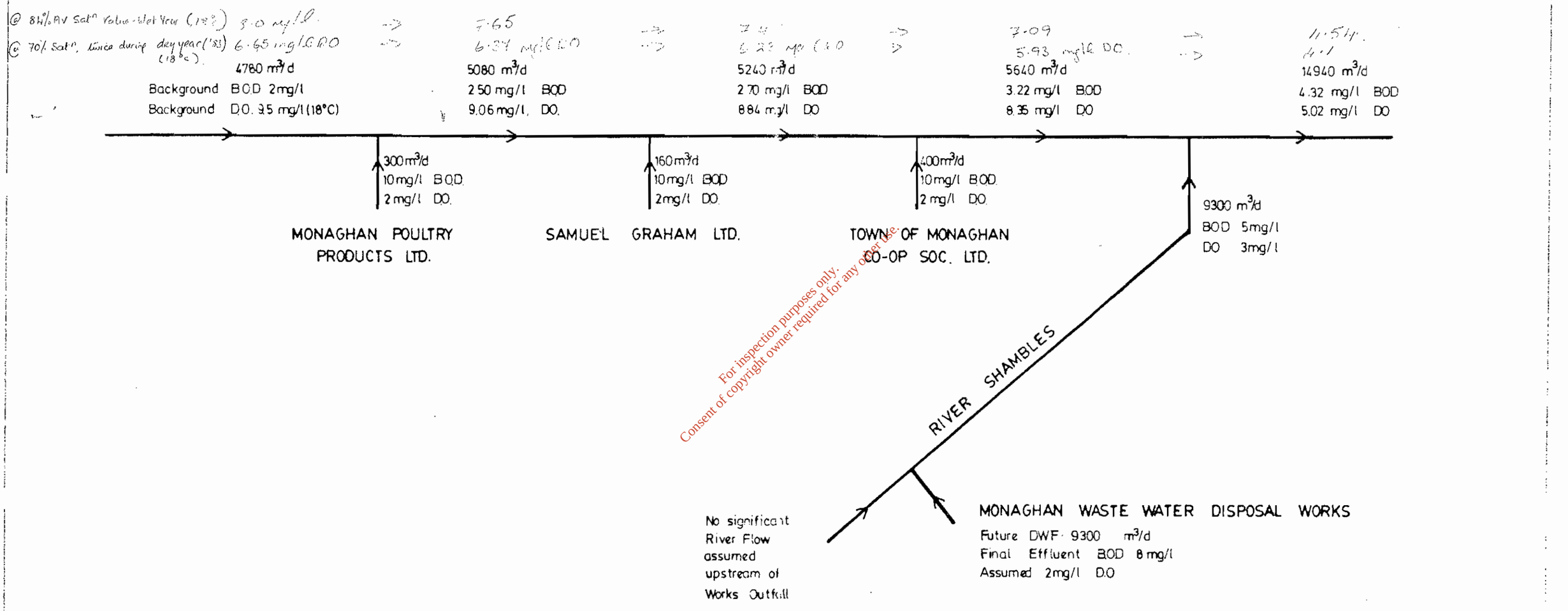

FIG 1. Calculated BOD and DO levels at 95 Percentile Flow Conditions with a future DWF of 9300 m³/d

NOTES
1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED BY THE CONTRACTOR OF ANY [illegible]

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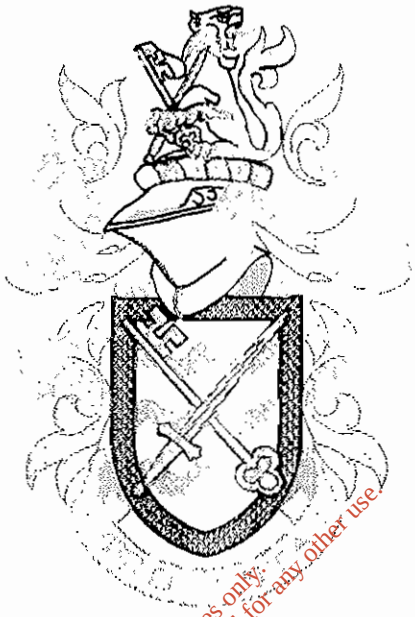
MONAGHAN WASTE WATER DISPOSAL SCHEME

SCALES	DRN	DATE	DRG NO
N.T.S	CK	APR '86	

Institution of Water and Environmental Management

Northern Ireland and Republic of Ireland Branches



Joint Meeting 25th March 1994

Monaghan Urban District Council

Monaghan Waste Water Treatment Works

Patrick J. Tobin and Co. Ltd.,
Consulting Civil and Structural Engineers
Hynes Building, St. Augustine Street, Galway.
and
Bank of Ireland Chambers, Park St., Dundalk Co. Louth.

INSTITUTION OF WATER AND ENVIRONMENTAL MANAGEMENT

NORTHERN IRELAND AND REPUBLIC OF IRELAND BRANCHES

JOINT MEETING 25TH MARCH 1994

MONAGHAN URBAN DISTRICT COUNCIL

MONAGHAN WASTE WATER TREATMENT WORKS

This document has been prepared by Patrick J. Tobin & Co. Ltd. for the Annual Joint Meeting of the Northern Ireland and Republic of Ireland branches of the Institution of Water and Environmental Management held at the Monaghan Waste Water Treatment Works, Co Monaghan on 25th March, 1994.

Consulting Engineers

Patrick J. Tobin & Co. Ltd.,Hynes Building, St. Augustine Street, Galway.
and
Bank of Ireland Chambers, Park Street, Dundalk, Co Louth.

MONAGHAN WASTE WATER DISPOSAL WORKS SCHEME

INSTITUTION OF WATER AND ENVIRONMENTAL MANAGEMENT
NORTHERN IRELAND AND REPUBLIC OF IRELAND BRANCHES

JOINT MEETING 25TH MARCH 1994

MONAGHAN URBAN DISTRICT COUNCIL
MONAGHAN WASTE WATER DISPOSAL WORKS SCHEME
WASTE WATER TREATMENT PLANT

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Appendix No. 1. Drawings

Appendix No. 2. Schedule of Contractors, Sub Contractors and Suppliers

INSTITUTION OF WATER AND ENVIRONMENTAL MANAGEMENT
NORTHERN IRELAND AND REPUBLIC OF IRELAND BRANCHES

JOINT MEETING 25TH MARCH 1994

MONAGHAN URBAN DISTRICT COUNCIL
MONAGHAN WASTE WATER DISPOSAL WORKS SCHEME
WASTE WATER TREATMENT PLANT

1.0 INTRODUCTION

The Town of Monaghan was until the introduction of the New Treatment Works served by a Sewage Treatment Plant which comprised, coarse screening, an Imhoff tank, 4 No. Percolating Filters and 2 No. Humus Tanks. This plant was constructed in the early 1970s but with the increase of population in the Town of Monaghan allied to the growth of industry in the area, the existing facilities became both hydraulically and biologically overloaded.

A Preliminary Report was prepared by Patrick J. Tobin & Co. in 1984 with a view to providing a modern disposal works for Monaghan Town, adequate to cater for the projected requirements to the year 2014 AD. The design of the scheme included a detailed examination of the receiving waters as both the Shambles and Blackwater Rivers, are sensitive and delicately balanced with respect to the Monaghan Dry Weather Flow during low flow periods.

It was decided during the course of preparation of the Preliminary Report that the existing works would be retained but would be operated at a level of duty more in keeping with its original design and consequently the hydraulic and biological capacity of the existing works were taken into consideration in the overall re-design of the facilities at Monaghan.

The Monaghan Waste Water Disposal Works Scheme has thus provided for the construction of a new Waste Water Treatment Plant adjacent to the existing works. The new Treatment Works will operate together with the existing works to provide a system of treatment and disposal of waste water from the Town of Monaghan and its environs. The new works has been constructed on a site in the Townland of Tirkeenan and is located to the South East of Monaghan Town with access from the Monaghan to Dublin road (N2). The treated effluent from the Treatment Works is discharged via an outfall pipeline to the nearby Shambles River which in turn discharges to the Blackwater River some 1600m to the North of the Treatment Works Site.

2.0 CIVIL ENGINERING WORKS

While the main purpose of this paper is to outline the overall process design of the works and to provide details of the Mechanical and Electrical installation, it would be incomplete without making some reference to the details of the Civil Engineering Works Contract.

The Main Civil Engineering Works Contractors P.J. Walls (Civil) Ltd. carried out a difficult task of constructing major Tanks and Structures on a site where ground conditions were extremely difficult.

2.1 Site Investigation

Site Investigation was carried out on the site in November 1987and this showed variable underground conditions of sand and silt at variable depths. In one area the soft silt extended to 10m below ground level. Limestone rock was encountered generally 9m to 10m below ground level although it varied considerably across the site. High ground water levels were encountered and the use of piles was anticipated as necessary for support of the Primary Settlement Tanks and the Aeration Basins.

2.2 Construction

The Civil Engineering Works Contract commenced in August 1991. Trial Holes were first excavated and silt and sand conditions were encountered confirming the site investigation findings. Piling Specialists, (Lowry McKinney) carried out the necessary driving and testing of piles during October/November 1991.

Works commenced with the construction of the Stormwater Tank where ground conditions were relatively stable and as piled foundation supports were completed, construction of the other Tanks was put in hand. By May 1992 the main Units were constructed and left ready for the Plant Contractors. Work on the Plant Building and the Laboratory/Control Building commenced in January 1992 and by August 1992 these buildings were generally available to the Plant Contractors.

Construction of the Preliminary Units commenced in early July 1992 and they were completed and made available to the Plant Contractors by early September 1992.

The construction of the Sludge Stabilisation Tank, Thickeners and the Forward Feed Sludge Pumping Station followed in November 1992 and these were completed by Easter 1993.

2.3 Scope of Civil Engineering Works Contract

Overall the works included for construction of:

a. Preliminary Units with:
   (i) 2 No. vertical drum screens with 5mm slots.
   (ii) Grit Chamber
   (iii) Separating Flume (flow to Imhoff Tank and Percolating Filters)
b. Stormwater Separating Flume and Flow Splitting Chamber
c. Stormwater Tank 29m dia.
d. 2 No. Primary Settling Tanks each 29m dia.
e. 2 No. Aeration Tanks each 18m x 18m.
f. 2 No. Final Settling Tanks each 29m dia.
g. 1 No. Sludge Stabilisation Tank 19m dia.
h. 2 No. Sludge Thickeners (5m and 10m dia.).
i. Stormwater Return Pump Sump.
j. Surplus Sludge Pump Sump.
k. Sludge Return Pump Sump.
m. Sludge Dewatering/Ferric Sulphate Dosing/Air Blower Plant House.
n. Sludge Forward Feed Pumping Station.
o. Laboratory/Control Building.

The Civil Engineering Works Contract also included:

- ☐ Dia. 900mm Ductile Iron Interconnecting Pipework on concrete supports between the Preliminary Units and the Stormwater Separating Flume.
- ☐ Dia. 500mm and dia. 600mm Interconnecting Pipework between the Primary Settlement Tanks, Aeration Basins and Final Settlement Tanks.
- ☐ Dia. 200mm Sludge Return Pipework.
- ☐ Drainage Pipework ranging from dia. 100mm to dia. 225mm.
- ☐ Surface Water Drainage Pipework ranging from dia. 225mm to dia. 450mm.
- ☐ Dia. 450mm Ogee Land Drainage Pipework.
- ☐ Cable Ducts ranging in size from dia. 100mm to dia. 200mm.
- ☐ Dia. 150mm Watermain with hydrants for water supply and fire fighting.

All pipework was tested and cleaned and a CCTV survey of the completed work was carried out.

Site Development included:-

- ☐ Site Preparation
- ☐ Roads
- ☐ Paths
- ☐ Embankments
- ☐ Palisade Fencing
- ☐ Landscaping

Monies allowed for rehabilitation of sewers was used in a comprehensive CCTV Survey of the existing town sewerage system with reconstruction of some new sections of sewers and repair by part relining to seal structural damage to existing pipes in the main streets.

The Civil Engineering Works Contract also included for cleaning down and refurbishment of the Existing Treatment Works. This work also included for re-routing of the inlet pipework to the Imhoff Tank, cleaning of media in the Percolating Filters and repairs to the existing buildings on site. This work did not start until flow was diverted to the New Works on 18th January this year, and is still ongoing.

Labour on site at commencement was about 10 persons but this increased to 45 persons (20 skilled) at peak times.

3.0 DESCRIPTION OF TREATMENT WORKS

3.1 Treatment Process

All sewage from the Town of Monaghan arrives at the newly constructed Preliminary Units. The flow entering the works is screened and degritted and is divided into two streams of treatment. The first stream of treatment directs flow to the Old Treatment Works. The Old Works will take flows up to 1365 m³/day, with all other flows being diverted to the second stream of treatment. In the old Works the settled sewage from the Imhoff tanks flows to a Dosing Chamber via an overground cast iron pipe on concrete supports. The sewage entering the Dosing Chamber is divided between the four Percolating Filters. There are two Humus tanks, each tank providing settlement for the effluent from two of the Percolating Filters. The final effluent from each of the Humus tanks is combined in a diameter 300mm pipeline and is returned to the Storm Water Pump Sump so that it can be recirculated through the Activated Sludge Plant prior to final disposal. This measure has been taken because the standard of the final effluent from this plant could not be guaranteed to be within the design range of:

BOD:	10 to 20 mg/l
Suspended Solids:	20 to 30 mg/l

A separate collection sump from the Old Works transfers excess sludge to the Surplus Sludge Pump Sump where it is combined with primary sludge and waste activated sludge from the New Activated Sludge Plant and subsequently thickened, stabilised and dewatered.

The second stream of treatment is designed to treat all flows within the range of 1,365 to 38,360 m³/day. Flows in excess of 38,360 m³/day will be discharged to the Storm Water Settling Tank. The second stream of treatment uses the conventional Activated Sludge Treatment Process. It comprises of 2 No. Primary Settling Tanks, 2 No. Aeration Basins, 2 No. Final Settlement Tanks along with the necessary Sludge Return and Sludge Wastage facilities normally associated with such a plant. The surplus sludge from the plant will be thickened, stabilised and dewatered.

The works also contains a facility for the removal of phosphates. This will be achieved using Ferric Sulphate as a coagulant and the phosphate will be chemically precipitated from the waste water stream.

3.2 Administrative and Plant Buildings

Within the Treatment Works itself, there are a number of buildings with discrete functions. These are as follows:

(i) Main Administration Building

This building houses the Laboratory and Control Centre for the entire works along with a Canteen, Toilet and Shower facilites.

(ii) Sludge Dewatering/Ferric Sulphate Dosing/Air Blower Building

This building houses all mechanical and electrical plant associated with the Sludge Dewatering installation and the Phosphate Removal Installation. The Main Air Blowers which supply air to the Fine Bubble Diffused Aeration System are housed on the first floor of this building. In addition it also houses the boilers for the heating system along with store and workshop facilities.

(iii) Sludge Pumping Station

A separately constructed Pumping Station houses the progressive cavity pumps which abstract the thickened or stabilised sludge for subsequent treatment.

3.3 Plant Flexibility

In designing the Treatment Works at Monaghan a large emphasis was placed on the operational flexibility of the plant. This was to ensure that when the plant becomes operational the Works Manager will be able to select process options which are the most suitable at any given time.

3.3.1 Interconnecting Pipework Arrangements:

In the design of the activated sludge plant, the units have been configured so that:

(i) Flow can be divided into two parallel streams

(ii) Either Primary Settlement Tank can feed either Aeration Basin

(iii) Either Aeration Basin can feed either Final Settlement Tank

(iv) Surplus Activated sludge can be returned to the Primary Settlement Tanks or alternatively can be separately thickened.

3.3.2 Sludge Management:

In the Executive Summary of the Sludge Strategy recently lodged with the Department of the Environment the recommended sludge treatment technology for the Monaghan Region is as follows:

(i) Thickening/dewatering/biodrying
(ii) Composting
(iii) Anaerobic digestion

The recommended sludge disposal/utilisation categories listed are:

(i) Landspread 100%
(ii) Landfill

The design and installation of the plant at Monaghan was on-going during the preparation of this Strategy and it was decided that flexibility in selection of sludge handling operations should be included. The system was also designed to accommodate the inclusion at some time in the future of an Anaerobic Sludge Digester. The heating system in the buildings is a Propane Gas fired system and this can be readily converted to run on Excess Methane Gas generated by such a system.

The main sources of sludge at the Monaghan Plant are as follows:

(i) Sludge from Imhoff Tank.
(ii) Sludge from Humus Tanks.
(iii) Sludge from Primary Settlement Tanks.
(iv) Excess Activated Sludge from Final Settlement Tanks.

In order to allow maximum flexibility in operation and also to cater for the possible inclusion some time in the future of Sludge Digestion Equipment, the following facilities have been provided:

(a) Sludge Stabilisation Tank

A Sludge Stabilisation Tank with a diameter of 19m and incorporating a Fine Bubble Diffused Aeration system has been constructed. This Tank is designed to stabilise combined thickened sludges from the entire Plant or to separately stabilise a combination of Primary, Imhoff and Humus sludge.

Sludge stabilization will achieve the following:

(i) Reduction in Volatile Solids.
(ii) Lower BOD concentrations in supernatent liquor.
(iii) Production of an odourless humus like biologically stable end product that can be disposed of easily.
(iv) Production of a sludge with excellent dewatering characteristics.

Sludge from the Stabilisation Tank may be pumped directly to the Sludge Press House for subsequent dewatering.

(b) Sludge Thickener No. 1

A Sludge Thickener with a diameter of 10m has been constructed. This unit will be used mainly to thicken excess activated sludge prior to either dewatering or subsequent digestion (in the future). It should be noted that if a Digestion plant is installed in the future, the 19m dia. sludge stabilisation tank could revert to being used as a digested sludge holding tank to hold sludge for the requisite period of time prior to landspreading.

(c) Sludge Thickener No. 2

A Sludge Thickener with a diameter of 5m has been constructed. The main purpose of this unit is to thicken Primary/Humus sludge prior to either dewatering or subsequent digestion (in the future).

Flexibility in Sludge Thickening

While two Thickeners have been provided to allow for separate thickening of Primary and Secondary Sludges there are also a number of other advantages:

(i) Either thickener can be used to thicken combined sludge from all of the works. This has allowed use of the smaller thickener on plant start up. During the early stages of operation of the plant the operator has the choice of confining thickening to the smaller unit and holding the larger unit on standby for sludge storage.

(ii) If a sludge digestor is installed then a facility is provided whereby the digestors can be fed from alternate thickeners, thus allowing for sampling of the sludge prior to pumping forward for subsequent digestion. This would be of particular importance if for example a decision was taken to treat imported sludges in which case one of the thickeners could be used in parallel with a Sludge Acceptance Plant to receive incoming sludges.

Finally it should be noted that in the long term development of the works at Monaghan, a situation may arise where:

(i) Excess activated sludge would be thickened and dewatered without digestion (on dewatering unit No. 1).

(ii) Primary/Imhoff sludge would be thickened, digested and subsequently returned to the Digested Sludge Holding Area. The digested sludge after the appropriate holding period could be spread on land or alternatively dewatered (on Dewatering Unit No. 2) and brought to a landfill site.
Because of the range of options in sludge handling outlined in the preceding paragraphs the sludge dewatering equipment now installed at Monaghan has been designed to handle:

(a) Combined sludge from the entire plant, fed from the Stabilisation Tank.
(b) Primary sludge alone fed from the Primary Sludge Thickener.
(c) Excess activated sludge alone fed from the excess activated sludge thickener.
(d) Combined sludge fed from either thickener.

It is intended to eventually install two dewatering units, which will act on a duty/standby basis or alternatively will be able to act independently of one another to handle primary (digested or undigested) and secondary sludges respectively. For the present time however only one dewatering unit has been installed and the addition of a second unit will only be considered as the plant approaches its full design throughput.

3.3.3 Flexibility in Phosphate Removal Options

It is generally recognised that there are three variations on the addition of coagulants for phosphate removal, each of which requires different modifications to the activated Sludge Process. The three variations are namely:
(i) Preliminary Coagulation
(ii) Simultaneous Coagulation
(iii) Post Coagulation

In the Ferric Sulphate dosing installation at the Monaghan Plant dosing lines have been put in place so that the Plant Operators have the choice of either:

(i) Preliminary coagulation where the Ferric Sulphate is dosed into the w: water prior to primary settlement (dosing point at Flow Splitting Chamber)

(ii) Simultaneous coagulation where the Ferric Sulphate is added to the outlet of the Primary Settlement Tanks (dosing points at Outlet Chambers)

(iii) Post coagulation where the Ferric Sulphate is added after the biological treatment (dosing points at Aeration Basin Outlets)

The following Tabulation (compressed from published literature) sets out the advantages and disadvantages of each system.

Table No. 2 - Phosphate Removal Options, Advantages and Disadvantages

Primary Coagulation	Simultaneous Coagulation	Post Coagulation
	ADVANTAGES	
Good mixing required Coagulant enhances settlement	Diffusers ensure thorough and rapid mixing	By far the most effective phosphorous removal system
Removes orthophosphate present as well as reducing organic load	Adding the coagulant at this stage ensures that more phosphorous is removed as more of the phosphorous will be present as orthophosphate	All phosphorous present has been hydrolised to orthophosphate and is potentially removable
Sludge thickening & Mechanical dewatering improved	Enhanced settling of mixed liquor (minimizes the risk of sludge bulking)	
	DISADVANTAGES	
Organic phosphate and polyphosphate which has not yet been hydrolised to orthophosphate will not be removed and carries through to the Aeration Basin. They will be broken down to orthophosphate in the Aeration Basin and discharged in the final effluent	Turbulence caused by the aeration system can cause the chemical floc to break up, reducing the settleability of the sludge.	Because chemical floc is returned to the Aeration Basin the mixed liquor has a lower ML VSS. A higher than usual MLSS may consequently be required to maintain adequate B.O.D. removal
Requires higher coagulant usage for same degree of phosphorous removal		
Micro organisms in the Aeration Basin require orthophosphate for metabolism. There may be an insufficient C:P ratio in the Aeration Basin following preliminary coagulation.		

The post coagulation method has been selected for commissioning purposes, at the Monaghan Site. During the lifetime of the works the Plant Manager will be able to select from the three options outlined above to make the most effective overall process decisions.

4.0 PLANT LOADINGS

The following is a summary of the parameters used in the design of the Treatment Works.

The Dry Weather Flow and organic load were calculated as follows:

(a)	**Dry Weather Flow**	**Loading**
	10,000 persons at 250 l/h/day	2,500 m³/day
	Trade Sources	2,500 m³/day
	Bacon Factory	400 m³/day
	Industrial Allowance	3,900 m³/day
	TOTAL DRY WEATHER FLOW	**9,300 m³/day**

(b)	**Organic Load in Terms of BOD**	**Loading**
	10,000 persons @ 0.065 kg BOD/h/day	650 kg BOD/day
	Trade, Cafes, Hotels	200 kg BOD/day
	Bacon Factory	
	400 cu.m/day @ 550 mg/l BOD	220 kg BOD/day
	Other Industry	
	3,900 cu.m/day @ 400 mg/l BOD	1,560 kg BOD/day
	TOTAL BOD LOAD	**2,630 kg BOD/day**
	Average BOD concentration	*283 mg/l*

(c)	**Suspended Solids**	
	5,000 m³/day @ 300 mg/l	1,500 kg/day
	400 m³/day @ 600 mg/l	240 kg/day
	3,900 m³/day @ 400 mg/l	1,560 kg/day
	TOTAL SUSPENDED SOLIDS	**3,300 kg/day**
	Average concentration	*355 mg/l*

(d) Maximum Flow for Full Treatment

The maximum flow for full treatment was calculated using the following formula from the Activated Sludge Manual of British Practice in Water Pollution Control published by The Institution of Water and Environmental Management.

Maximum Flow for Full Treatment:

[(PG + I + E) + 1.36P + 2E] m³/day

Where: P = Population

G = Average Domestic Water Consumption (m³/hd.d)

I = Infiltration (m³/d)

E = Industrial Effluent (m³/d)

In the present case assuming an infiltration rate of 20% of Dry Weather Flow we get the following:

P = 10,000

G = 0.25 m³hd.d

I = 1,860 m³/day

E = 3900 + 400 + 10,000 (0.25) = 6800 m³/day

Max Flow = [(10,000)(0.25) + 9300 (0.2) + 6800) + 1.36 (10,000) + 2(6800)]

= [2500 + 1860 + 6800 + 13,600 + 13,600] = **38,360 m³/day**

(This represents 4.12 times D.W.F.)

(e) Division of Flow Between the Old Works and the New Activated Sludge Plant

(i) Division of Flow

It has been arranged that there will be a pro rata division of dry weather flows up to 9,300 m³/day between the Old Works and the New Activated Sludge plant in the ratio 1365:7935 respectively.

For flows greater than 9,300 m³/day there would be a flow of 1365 m³/day to the Old Works and with the balance up to a maximum of 36,995 m³/day (i.e. 38,360 - 1365) to the New Activated Sludge Plant. Flows in excess of 38,360 m³/day will be discharged to the Stormwater Settling Tank.

(ii) Division of Organic Load

The total BOD load of 2,630 kg/day will be divided between the old works and the new activated sludge plant as follows:-

BOD load to old works

$$= \frac{1{,}365}{9{,}300} \times 2630 = 386 \text{ kg B.O.D./day}$$

BOD load to New Activated Sludge Plant

$$= \frac{(9300 - 1365) \times (2630)}{9300} = 2244 kg/BOD/Day$$

(e) Summary of Loadings on New Activated Sludge Plant

(i) Hydraulic Load

Dry Weather Flow = 7,935 m³/day = *91.8 l/sec*
= *(331.0 m³/hour)*

Peak Flow = 36,995 m³/day = *482.2 l/sec*
= *(1542 m³/hour)*

Recirculated Flow from Old Works = *16.2 l/sec*
= 1,365 m³/day = *(58.12 m³/hour)*

(ii) Organic Load

2244 kg/BOD/day = *283 mg/l*

5.0 DETERMINATION OF SLUDGE VOLUMES

The estimated daily volume of surplus sludge from the Treatment Works is calculated as follows:

Table No. 1 Summary of Sludge Production

Sludge Source	Mass of Sludge	Dry Solids Content	Volume
Old Works			
(i) Imhoff Sludge	242.3 kg	5.0%	4.85 cu.m
(ii) Humus Sludge	137.9 kg	1.0%	13.8 cu.m
(iii) Primary Sludge	1825.0 kg	5.0%	36.5 cu.m
New Works			
(iv) Surplus Activated Sludge	938.0 kg	1.0%	93.8 cu.m
(v) Sludge from Phosphate Removal	220.0 kg	1.0%	22.0 cu.m
TOTAL	***3363.2 kg***		***170.95 cu.m***

6.0 DESCRIPTION OF THE TREATMENT UNITS

6.1 Preliminary Units

The Preliminary Units at the Monaghan Waste Water Treatment Plant are designed for removal of screenings, removal of grit and flow splitting. Screening is provided by means of 2 No. Jones and Attwood vertical drum screens Model No. 450SL each with a flow capacity of 480 litres/sec and a 5mm slot width.

The screenings are removed from the flow and are dewatered by means of 2 No. Jones and Attwood screw compactors which discharge the dewatered screenings to a covered skip in the adjacent holding area.

Following screening, grit is removed from the influent by means of a Jones and Attwood Jeta Grit Trap. The grit is discharged to a separate grit skip in the skip holding area after it has been passed through a Jones and Attwood Grit Classifier.

Finally, a Flow Separating Flume is provided in order to carry out a pro rata division of the dry weather flow between the Old Works and the New Activated Sludge Plant.

The equipment in the Preliminary Units is controlled from a separate control panel mounted in a kiosk at the Preliminary Units. The operation of all equipment is monitored through the central Telemetry System at the main control room in the Administration Building.

6.2 Existing Plant

The existing plant comprises 1 No. Imhoff Tank with dimensions 15.85m x 8.55m x 9.67m deep. A Dosing Chamber and 4 No. Percolating Filters each with a diameter of 24.5m together with 2 No. Humus Tanks with dimensions of 5.5m x 5.5m x 6.35m deep are also provided. Final effluent from the Existing Works will be recirculated through the Stormwater Pump Sump, and on to the New Activated Sludge Plant for polishing, prior to discharge to the Shambles River.

6.3 Stormwater Settling Tank and Stormwater Separating Flume

Storm flows in excess of 38,360 m³/day will be discharged to the Stormwater Settling Tank over the weir of the storm overflow, located upstream of the Stormwater Separating Flume.

The Stormwater Settling Tank has an internal diameter of 29m, a side wall depth of 2.8m and a base with slope of 7.5° giving a volume of 2270 m³. This will give a retention time of 5.9 hours for a dry weather flow of 9300 m³/day.

The Stormwater Settling Tank initially acts as a holding tank to retain the first flush which will contain the most strongly polluted storm water. If the storm is of sufficient intensity and duration to fill the tank, it will then act as a Primary Settling Tank with the settled stormwater being discharged directly to the Shambles River. When the storm has dissipated the entire contents of the Stormwater Settling Tank can be discharged gravitationally to the Stormwater Return Pump Sump and returned to the main flow at a manhole upstream of the Stormwater Separating Flume.

The Stormwater Return Pump Sump contains two submersible pumps which will act on a duty and standby basis. The capacity of the storm pumps is 70 litres/second against a total manometric head of 8.45m. In addition to pumping stormwater these pumps also return the supernatant liquor from the Sludge Thickeners and Sludge Stabilisation Tank and also will be used to recirculate the final effluent from the Old Works into the main flow to the New Activated Sludge Plant

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A sluice valve with an electric actuator is incorporated in the 300mm dia. outlet pipeline from the Stormwater Settling Tank to the Stormwater Return Pump Sump. The operation of this actuator is controlled by a signal from the central Telemetry System which is in turn dependant on the value of flow measured at the Stormwater Separating Flume. The sluice valve will open when the flow passing through the flume for full treatment falls below 661 m³/hour (1.7 DWF) and closes when the flow increases to 1440 m³/hour (3.7 DWF).

The automatic return of the contents of the Stormwater Holding Tank as described above ensures that the tank will be emptied at the end of the storm leaving the capacity of the tank available to cater for the next storm. Emptying the tank over a period of nine hours means that there will not be an excessive loading on the Treatment Plant. A timer is also incorporated in the actuator control circuit so as to give the option of returning the contents of the Stormwater Settling Tank at night time when the flow to the Treatment Works is low.

6.4 Primary Settling Tanks

Two Primary Settlement Tanks each having an internal diameter of 29 m have been provided. The details of the tanks are set out below:

(i)	Internal diameter	-	29 m
(ii)	Surface area	-	660.5 m²
(iii)	Volume	-	1877 cu.m
(iv)	Side wall depth	-	2.0 m
(v)	Slope of Floor	-	10°
(vi)	Maximum Flow to each Tank	-	799.17 m³/hour (19.180 m³/day)
(vii)	Surface Loading Rate	-	29.04 m³ per m²/d or 1.21 m³ per m²/hr
(vii)	Weir Overflow Rate at Maximum Flow	-	210.52 m³/m/d
	Weir Overflow Rate at Average Flow	-	51.04 m³/m/d.
(viii)	Retention Time at Maximum Flow	-	2.35 hours.
	Retention Time at Dry Weather Flow	-	9.69 hours

Thus the two Primary Settling Tanks have a capacity to cater for peak flows of 1650 m³/hour. BOD and suspended solids removal in the Primary Settling Tanks are estimated at 35% and 65% respectively giving performance characteristics for the primary stage of the treatment as follows:

Characteristic	**BOD**
Incoming Effluent Concentration	283 mg/l
Incoming Effluent Load	2244 kg/day
Removal Efficiency	35%
Ongoing Effluent Concentration	184 mg/l
Ongoing Effluent Load	1466 kg/day

6.5 Aeration Basins

Two Aeration Tanks each having plan dimensions 18.0 metres by 18.0 metres and a liquid depth of 4.75 m have been provided. Completely mixed reactors have been selected in order to achieve uniform loading conditions and to provide buffering of any shock loads.

The details for each of the Tanks are set out below:

(i)	Volume	1539 cu.m
(ii)	DWF to each Tank	3967.5 cu.m/day
(iii)	Retention Time @ D.W.F.	9.31 hours
(iv)	Sidewall/Depth Ratio	3.8
(v)	Incoming B.O.D. Load	1466 kg/day
(vi)	Incoming Effluent B.O.D. Concentration	184 mg/l
(vii)	Final Effluent B.O.D. Concentration	15 mg/l
(viii)	BOD Load removed per Tank = $\frac{7935\ (184 - 15)}{1000 \times 2}$ =	*670 kg/day*
(ix)	F/M Ratio	
	Min. MLSS Concentration	3000 Mg/l
	F/M Ratio = $\frac{670 \times 1000}{(1539)\ (3000)}$ =	*0.15 Kg BOD/Kg MLSSd*
(x)	Organic Loading = $\frac{670}{1539}$ =	*0.435 Kg BOD/day/m³ (= 435 mg/l)*
(xi)	Oxygen Required	1.8 Kg.0_2/kg BOD
	Total Oxygen Required	1206 KG.0_2
	Total Oxygen Required for both Tanks	2412 Kg 0_2

A system of Fine Bubble Diffused Aeration has been incorporated into the Aeration Basins. At the time of tender both Surface Aeration and Fine Bubble Diffused Aeration were examined as alternatives. Having considered the advantages and disadvantages of both systems, the Fine Bubble Diffused Aeration System was eventually selected as this system had the lowest nett present cost based on a capital budgeting evaluation.

The Fine Bubble Diffused Aeration System comprises of GVA diaphragm type disc diffusers. Each diffuser has a diameter of 315mm and the diffusers are placed at 1000mm centres.

The entire Aeration System was independently tested under standard conditions in December of 1993 and an Oxygen Transfer Efficiency of 3.5 kg 0_2/kwh was recorded. (Power consumption measured at the Control Panel). This compared favourably with the Guaranteed Oxygen Transfer Efficiency of 2.7 kg 0_2/kwh which was quoted at the time of tender. On other plants recently tested (at standard conditions) under the supervision of this Office and where surface aeration rather than diffused air is employed, oxygen transfer efficiencies of 1.6 to 1.9 kg 0_2/kwh were achieved. This comparison demonstrates the improved performance available with the use of Fine Bubble Diffused Aeration system over and above the Surface Aeration system. During this test the air distribution systems in both Aeration Basins and in the Stabilisation Tank were run concurrently so that the maximum output of the Blowers would be checked during the tests.

Two separate tests were carried out, one on Aeration Basin No. 1, the other on the Sludge Stabilisation Tank.

In both tests the performance proved better than the oxygen transfer figures originally guaranteed by the Contractor. The results achieved were as follows:

Table No 3 - Test Results at Standard Conditions

Test No.	Tank	Standard Oxygenation Capacity Value Required	Standard Oxygenation Capacity Value Achieved
1	Aeration Basin No. 1	88.29 kg/hour	99.3 kg/hour
2	Stabilisation Tank	102 kg/hour	139.1 kg/hour

In order to provide access to the diffusers, facilities have been put in place whereby the contents of one Aeration Basin can be transferred to the other over the course of a working day. An in-line Acid Cleaning system is also being considered.

6.6 Final Settling Tanks

Two Final Settling Tanks each having an internal diameter of 29.0 metres are provided. The details for each of the Tanks are set out below:

(i)	Internal Diameter	29.0 metres
(ii)	Surface Area	660.5 sq.m
(iii)	Volume	1877 cu.m
(iv)	Sidewall Depth	2.0 m
(v)	Slope of Floor	10°
(vi)	Max. Flow to each Tank:	
	(a) Flow to proposed Works	36,955 cu.m/day
	(b) Flow from Existing Works	1,365 cu.m/day
	(c) Return Sludge .5 (7935)	3968 cu.m/day
	Max Flow to 2 Tanks	42,328 cu.m/day
	Max Flow to each Tank	882 cu.m/hour/tank
(vii)	Surface Loading Rate	32 cu.m/sq.m/day
		1.35 cu.m/sq.m/hour
(viii)	Weir Overflow Rate	
	- at Max. Flow	232.3 cu.m/m/day
	- at Average Flow	51 cu.m/m/day
(ix)	Retention Time at Maximum Flow	2.13 hours

The two tanks in combination will cater for peak flows of up to 1764 m³/hour.

6.7 Sludge Pumping Stations

6.7.1 Surplus Sludge Pumping Station

This is a submersible pumping station and is located adjacent to the Primary Settlement Tanks. Primary Sludge, Humus Sludge and Excess Activated Sludge (recirculated through the Primary Settlement Tanks) are collected and mixed in this pump sump and subsequently pumped to the Stabilisation Tank or the relevant sludge thickener. The sump contains two submersible pumps which act on a duty/standby basis.

6.7.2 Sludge Return Pumping Station

This is located adjacent to the Final Settlement Tanks and is designed to return process sludge (activated sludge) to the individual outlets of the Primary Settlement Tanks. Waste sludge is returned to the Flow Splitting Chamber, recirculated through the Primary Settlement Tanks and subsequently withdrawn through the Surplus Sludge Pump Sump. Alternatively a separate set of duty/standby pumps has been provided to allow pumping of excess sludge to either of the Picket Fence Thickeners.

6.7.3 Sludge Forward Feed Pumping Station

This station is located adjacent to the Sludge Stabilisation Tank and Thickeners and contains a total of six positive displacement forward feed pumps (divided into three duty/standby sets of pumps, used for abstraction of sludge from the Stabilisation Tank, Picket Fence Thickener No. 1 and Picket Fence Thickener No. 2 respectively). The pumps are arranged so that sludge can be pumped forward in the following combinations.

Table No. 4 - Sludge Pumping Options Available

FROM/TO	Stabilisation Tank	Sludge Press No. 1	Sludge Press No. 2 (Future)	Tanker Connection	Sludge Digester (Future)
Stabilisation Tank	No	Yes	Yes	Yes	Yes
Thickener No. 1	Yes	Yes	Yes	Yes	Yes
Thickener No. 2	Yes	Yes	Yes	Yes	Yes

7.0 AIR BLOWER INSTALLATION

The air supply for the fine bubble diffused aeration system in the Aeration Basins and in the Stabilisation Tank is provided by means of 2 No. (1 duty and 1 standby) air blowers. Turbo blower units have been provided at the Monaghan Plant. A number of combinations of blower types were examined before the final selection was made in order to ascertain which blower installation would prove most efficient. It was decided, taking a long term view that the centrifugal blowers manufactured by HV Turbo would provide the most efficient solution.

The Blower Units are housed on the first floor of the Ferric Sulphate/Sludge Dewatering/Air Blower Plant House. Air from the blowers is transferred to both the Aeration Basins and the Stabilisation Tank through a diameter 300mm Ductile Iron pipework system. An Air Flow Splitting Chamber is located adjacent to the Stabilisation Tank and at this point measurement of the flow to both the Stabilisation Tank and the Aeration Basins is carried out. At the inlet to the Aeration Basins, there are electrically actuated butterfly valves with proportional control. The blowers operate under a constant pressure regime. This means that the vanes of the blowers are automatically adjusted in response to any change in pressure in the system so that constant pressure is maintained at all times. In effect, if there is an increase in pressure in the system, the output of the blowers will automatically be reduced until such time as the constant pressure value is re-established.

At the inlet side to the Aeration Tanks the position of the electrically actuated valves is varied in response to the dissolved oxygen levels in the Aeration Basins. If the dissolved oxygen level is too high, the valves will start to close with the consequent pressure increase in the system. The blowers respond to this pressure increase as previously outlined and restore the pressure to its operating level with the consequent reduction in air flow. In this way, the output of the blowers is controlled albeit indirectly by the dissolved oxygen level in the Aeration Basins.

8.0 PHOSPHATE REMOVAL

In view of the sensitivity of the Blackwater catchment into which the Treatment Works ultimately discharges, provision has been made for the inclusion of phosphate removal in the overall design of the scheme.

In the case of the Monaghan Waste Water Treatment Plant the phosphorous will be precipitated out of solution by the addition of a coagulant. The selected coagulant is Ferric Sulphate and the Treatment Works has been designed to include Bulk Storage and Dosing facilities.

The Bulk Storage Facility comprises 2 No. Helix Allibert HDPE bulk storage tanks each with a capacity of 24.4 m^3 which are located in a bunded area within the Sludge Dewatering/Ferric Sulphate Dosing/Air Blower building. The metering pumps which are Wallace and Tiernan G50V piston diaphragm pumps are located in the adjacent Chemical Dosing Room. Three pumps are provided, and these will act on a two duty and one standby regime.

8.1 Monitoring of Phosphate Concentrations in the Final Effluent

Monitoring of the phosphate concentrations in the final effluent will be carried out using a Bran and Luebbe in line phosphate monitor.

9.0 SLUDGE DEWATERING PLANT

The Sludge Dewatering Plant for the Monaghan Waste Water Treatment Works Scheme was the subject of a separate contract. In preparing the Contract Documents for the Scheme, Tenderers were given the opportunity to price for both Filter Belt Presses and Centrifuge (Decanter) units. Contractors were asked to submit Tenders on the basis of achieving a dewatered sludge with a solids content in the range of 22 - 25% with a stated and guaranteed dose rate of active polymer so that both the capital and the operational costs of the Sludge Dewatering Plant could be taken into consideration in reaching a final decision. The assessment of both machines was carried out under the following headings:

(i) Capital budgeting
(ii) Chemical, Power and Water consumption
(iii) Allocation of resources
(iv) Safety Health Welfare at Work and Odour Control.
(v) Flexibility of operation.

An evaluation of the running costs for both the Filter Press and the centrifuge were prepared for a fifteen year period. While the Sludge Dewatering Plant specified is designed to dewater a load of 3.363 tonnes of dry solids per day it was recognised that the plant at Monaghan would not immediately be required to deal with this amount of sludge. Consequently the evaluation of operating costs was based on a gradually increasing load over the 15 year assessment period. For the purpose of the exercise, it was assumed that the Filter Belt Press would have a polyelectrolyte usage of 3 kg of active product per tonne of dry solids and that the centrifuge would have a polyelectrolyte usage of 5 kg of active product per tonne of dry solids. The cost of polyelectrolyte was the major factor in the assessment. Electrical costs, belt replacement, water consumption etc. were minor in comparison.

In the final analysis the Filter Belt Press was selected and the arguments in favour of this selection are summarised as follows:

1. While the initial capital cost of a centrifuge would be lower than the initial capital investment for the Filter Belt Press, it was demonstrated that the nett present value of the centrifuge was in excess of the nett present value of the Belt Press. From the point of view of the Urban District Coucil, equal performance in sludge dewatering would be achieved using either of these machines. We have estimated that the operating cost to the Urban District Council will be approximately 30% lower with the Belt Press now installed.

2. While the Filter Belt Press consumes more water for washing than does the centrifuge, with careful management the filtrate may be used to wash the filter belt. While it is recognised that there may be times when town water will have to be used for belt washing, with good management, it should be possible to arrange for belt washing to be carried out using the filtrate. It is worth noting here that the wash water system at Monaghan is directly tied into the "Sludge Expert" Control System. The break tank on the wash water system is configured so that either filtrate or clean water can be used. When the "Sludge Expert" recognises that the quality of the filtrate is adequate for belt washing, then an automatically controlled solenoid valve shuts off the clean water supply and a similar solenoid valve allows the filtrate to discharge into the wash tank.

3. While safety health and welfare at work considerations are important, the filter press which has now been provided includes measures for screening operatives from aerosols and to this end an odour hood has been included with the filter belt press.

9.1 Filter Belt Press

The Filter Belt Press installed at Monaghan is a "Solids Technology Ltd." Series 5 Double Belt Press. The following guarantees were given by the Manufacturer at the time of tender.

Table No. 5 - Schedule of Guarantees for Filter Belt Press

No.	Sludge Type	Source	Dry Solids %	Based on Polyelectrolyte Usage (kg/Tonne Dry Solids)
1	Combined Primary,Imhoff, Humus and Excess Activated Sludges	Stabilisation Tank	22 - 25	< 4
2	Combined Primary,Imhoff, Humus and Excess Activated Sludges	Thickener	24 - 28	< 3.5
3	Combined Primary,Imhoff and Humus Sludges only	Stabilisation Tank	22 - 25	< 4
4	Combined Primary, Imhoff and Humus Sludges only	Thickener	24 - 28	< 3.5
5	Surplus Activated Sludge only	Thickener	18 - 20	< 4.5
6	Combined Digested Primary, Imhoff, Humus and Excess Activated Sludges	Digested Sludge Holding Tank (Future)	28 - 30	< 3
7	Combined Digested Primary, Imhoff and Humus Sludges only	Digested Sludge Holding Tank (Future)	28 - 32	< 3

9.2 Automatic Control of Filter Belt Press

In conjunction with the dewatering equipment at Monaghan, it is proposed to install a "Sludge Expert System". In essence the "Sludge Expert" is a micro processor based controller which automatically controls the flow of sludge and polymer to the Belt Press based on the quality of the filtrate emanating from the Press. The "Sludge Expert" will manipulate sludge polymer levels to find the optimum combination of sludge flow and polymer dosing and determines this optimum combination by monitoring the filtrate with a suspended solids meter. It is hoped that the incorporation of the Sludge Expert will reduce polymer consumption by 30 - 40% relative to manual operation of the machine. This however has yet to be proven on the Monaghan Site.

10.0 INSTRUMENTATION AND CONTROLS

In conjunction with the new Waste Water Treatment Plant at Monaghan, the following range of instrumentation has been installed.

1. Overall power consumption.
2. Dissolved oxygen level Aeration Basin No. 1.
3. Dissolved oxygen level Aeration Basin No. 2.
4. Dissolved oxygen level Sludge Stabilisation Tank.
5. Flow to Old Works.
6. Flow to New Activated Sludge Plant.
7. Sludge Return Rate of Flow Treatment Stream No. 1.
8. Sludge Return Rate of Flow Treatment Stream No. 2.
9. Air Flow Rate to Sludge Stabilisation Tank.
10. Air Flow Rate to Aeration Basins.
11. Final Effluent Rate of Flow.
12. Sludge Press Inflow.
13. Final Effluent Phosphate Level.
14. Ultrasonic Level Measurement in Pump Sumps (3 No.).
15. Ultrasonic Level Measurement in Ferric Sulphate Bulk Tanks.

In addition to the instrumentation listed above and in response to the requirements of the Urban Waste Water Directive the works is also equipped with a continuous sampling device at the Final Effluent Chamber so that composite 24 hour samples can be taken on a flow or time proportional basis. A refrigerated sampling unit is provided so that samples can be kept in good condition up until the time of analysis.

10.1 Telemetry System

The overall operational control of the plant is carried out through an "Allen Bradley" PLC located within the control panel in the Main Control Room of the Treatment Works. The PLC controls the following automatic sequences:

(i) Pro rata division of flows between the old works and the new activated Sludge Plant.
(ii) Automatic control of degritting operations.
(iii) Automatic control of the Turbo Blowers based on dissolved oxygen values and control of the Air Inlet Actuator at the Aeration Basins.
(iv) Control of Stormwater Return Pumping Equipment.

(v) Automatic control of submersible pumping equipment.
(vi) Monitoring of bulk chemical storage facilities.
(vii) Control of sludge return/sludge wastage valves.

The computer operating system is OS/2 Version 2.1 and the monitoring control software is Onspec. This is a standard off the shelf package which makes use of the facilities provided by the "OS/2 Presentation Manager". The software gathers signals from all the PLC outstations on a real time basis and places this data in tables and mimics on the VDU. These tables/mimics contain the status of all signals monitored by the PLC. The software is capable of communicating with a wide variety of PLCs and electrical instruments. The software is able to combine digital signals to create new digital conditions and is also able to generate digital signals from analogue points i.e. to establish when a control value has been reached.

Digital and analogue signals which are connected to the PLCs are accessible to the computer and are recorded on the computers hard disc. A tape drive has been fitted to the computer which automatically backs up the recorded data at user defined intervals. The user is able to view data recorded on the computers hard disc as "trends" on the screen, in a manner similar to data recorded on a chart recorder. The period over which the data is being viewed is user definable.

Maintenance Programme

The PLC calculates the total hours run for each motor on the basis of digital inputs from each control panel. Once a pre set number of operating hours has elapsed the PLC generates a "maintenance required" alarm. Each motor monitored by the system has an associated mimic on which the relevant pages in the Operating and Maintenance Manual are referenced. The Plant Operator can reset the timers for the various plant items using a switch provided on each mimic.

Finally, arrangements are currently being made so that the screen display for the "Sludge Expert" system can be repeated at the central computer. The information which will be carried on this display will include belt speed, polyelectrolyte flow rate, sludge flow rate and turbidity (as a percentage). It will also give the status of the current process being undertaken with the Sludge Expert i.e. whether it is:

(i) optimising polymer
(ii) optimising loading
(iii) operating in a steady state
(iv) an alarm condition prevails
(v) it is operating in manual mode
(vi) the "Sludge Expert" is locally switched to hand or automatic control.

In addition, a start or initiation output will be included so that the dewatering sequence can be remotely started from the central control location.

11.0 UPGRADING OF THE OLD WORKS

As part of the present Scheme, the refurbishment of the existing Treatment Works was arranged. This refurbishment included for complete cleaning down of the tanks, repairs and replacement to pipework in the Imhoff Tanks, refurbishment of the central columns on the Percolating Filters and replacement of the distribution arms. In addition, a complete safety review of the units was carried out on foot of which has followed replacement of all handrailing and walkway systems to bring them in line with current safety requirements. The work on these units could not commence until such time as the New Activated Sludge Plant had been commissioned and the old works could be taken out of service, so that this element of the works has only been very recently completed.

12.0 PROJECT TEAM AND PROJECT COSTS

12.1 Civil Engineering Works Contract

The Civil Engineering Works Contract was carried out by P.J. Walls (Civil) Ltd., Rosemount Office Park, Glandore Road, Griffith Avenue, Dublin 9. The overall Estimated Final value of the Civil Engineering Works Contract is IR£4,450,000.00.

12.2 Treatment Plant Contract

The Treatment Plant Contract was carried out by Jones Environmental (Ireland) Ltd., Richview, Clonskeagh, Dublin 14. The Estimated Final Cost of this Contract is IR£1,650,000.00.

12.3 Sludge Dewatering Plant and Ancillary Works

The Sludge Dewatering Plant has also been carried out by Jones Environmental (Ireland) Ltd. The Estimated Final Cost for this Contract is IR£280,000.00.

12.4 Total Project Cost

The Estimated Final Total Project Cost is IR£6,380,000.00.

13.0 COMMISSIONING OF THE WORKS

The final effluent standard specified in the Mechanical and Electrical Contract Documents was as follows:

BOD	10 to 20 mg/litre
Suspended Solids	20 to 30 mg/litre

with the ultimate results required to approach the lower end of the scales quoted above.

The Plant has now been in operation for a period of approximately two months and as such it is too early to comment on the overall performance of the works. However, in the most recently taken samples, the final effluent from the plant has attained the following standard:

BOD	10 mg/litre
Suspended Solids	12 mg/litre

14.0 ACKNOWLEDGEMENTS

The Author wishes to thank Mr. J. O. Gavin, County Manager, Mr. John K. Colleran, County Engineer, Monaghan County Council and the Members of the Monaghan Urban District Council for permission to present this Paper and visit the New Treatment Works at Tirkeenan.

The constant assistance of the Engineering and Administrative Staff of the Department of the Environment throughout the project is also gratefully acknowledged.

APPENDIX NO. 1

Drawings

LINE OF FUTURE INNER RELIEF ROAD

ULSTER CANAL (Disused)

LINE OF FUTURE INNER RELIEF ROAD

STORMWATER SETTLING TANK

PRIMARY SETTLING TANK NO1

PRIMARY SETTLING TANK NO2

AERATION TANK NO1

AERATION TANK NO2

FINAL SETTLING TANK NO1

FINAL SETTLING TANK NO2

SLUDGE THICKENING TANKS

PUMPING STATION

SLUDGE STABILISATION TANK

N

EXISTING HUMUS TANK

EXISTING IMHOFF TANK

NEW PRELIMINARY UNITS

EXISTING PERCOLATING FILTERS

EXISTING PERCOLATING FILTERS

EXISTING DOSING CHAMBER

EXISTING HUMUS TANK

OLD TREATMENT WORKS

NEW ACTIVATED SLUDGE PLANT

LABORATORY AND CONTROL BUILDING

PLANT HOUSE

MONAGHAN WASTE WATER TREATMENT WORKS

LAYOUT PLAN OF TREATMENT WORKS SITE

PATRICK J. TOBIN & CO. LTD.
CONSULTING ENGINEERS
GALWAY*DUNDALK
CASTLEBAR*LIMERICK

MONAGHAN WASTE WATER TREATMENT WORKS

SCREW COMPACTORS
SIZE 200 x 1000 LONG
C/W 0.75KW DRIVE MOTOR
380V – 3PH – 50HZ SUPPLY
220V ANTI-CONDENSATION HEATERS

MOTORISED LUBRICATOR – INTERLUBE
MINOR RADIAL 0.025/0.200
(7lb CAPACITY) c/w PARVALUX SD85
SINGLE REDUCTION BEARED MOTOR
0.02HP – 14RPM – 380V – 3PH
50HZ SUPPLY

BLUER GEARED MOTOR UNIT
1.5KW – 380V – 3PH – 50HZ
c/w 220V ANTI-CONDENSATION HEATERS

2No. JONES+ATTWOOD
VERTICAL DRUM SCREEN SIZE 450

21703

INCOMING FLOW

4160

1190

61.812

61.70

MANUALLY RAKED
SCREEN ON BYPASS

2000

FLOW TO NEW ACTIVATED
SLUDGE PLANT

61.70

6685

100NB(NP16)
GRIT DISCHARGE PIPEWORK

60.30

7250

JETA GRIT TRAP SIZE-900
DRIVE HEAD MOTOR 0.37KW
380V – 3PH – 50HZ SUPPLY
c/w 220V ANTI-CONDENSATION HEATERS

800

FLOW TO OLD WORKS

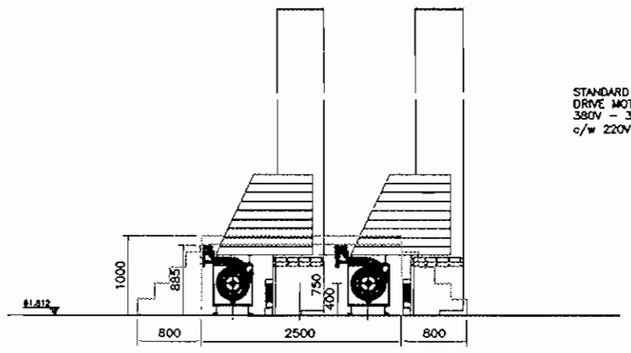
STANDARD GRIT CLASSIFIER
DRIVE MOTOR 0.75KW
380V – 3PH – 50HZ SUPPLY
c/w 220V ANTI CONDENSATION HEATERS

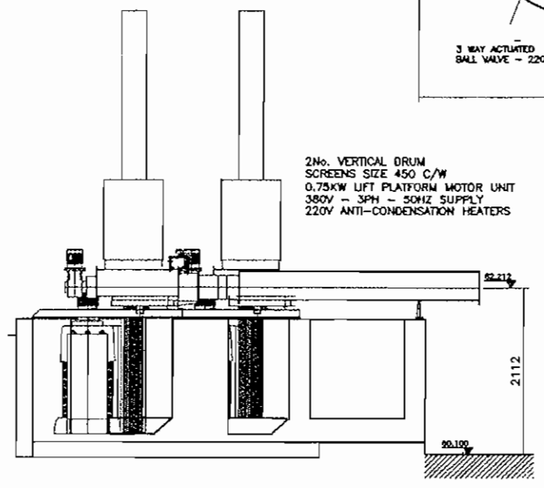
AIR BLOWER UNIT 5.5KW DRIVE MOTOR
380V – 3PH – 50HZ SUPPLY
c/w 220V ANTI-CONDENSATION HEATERS

1.5" ABS PIPEWORK
BLOWER TO JETA

3 WAY ACTUATED
BALL VALVE – 220V SUPPLY

5370

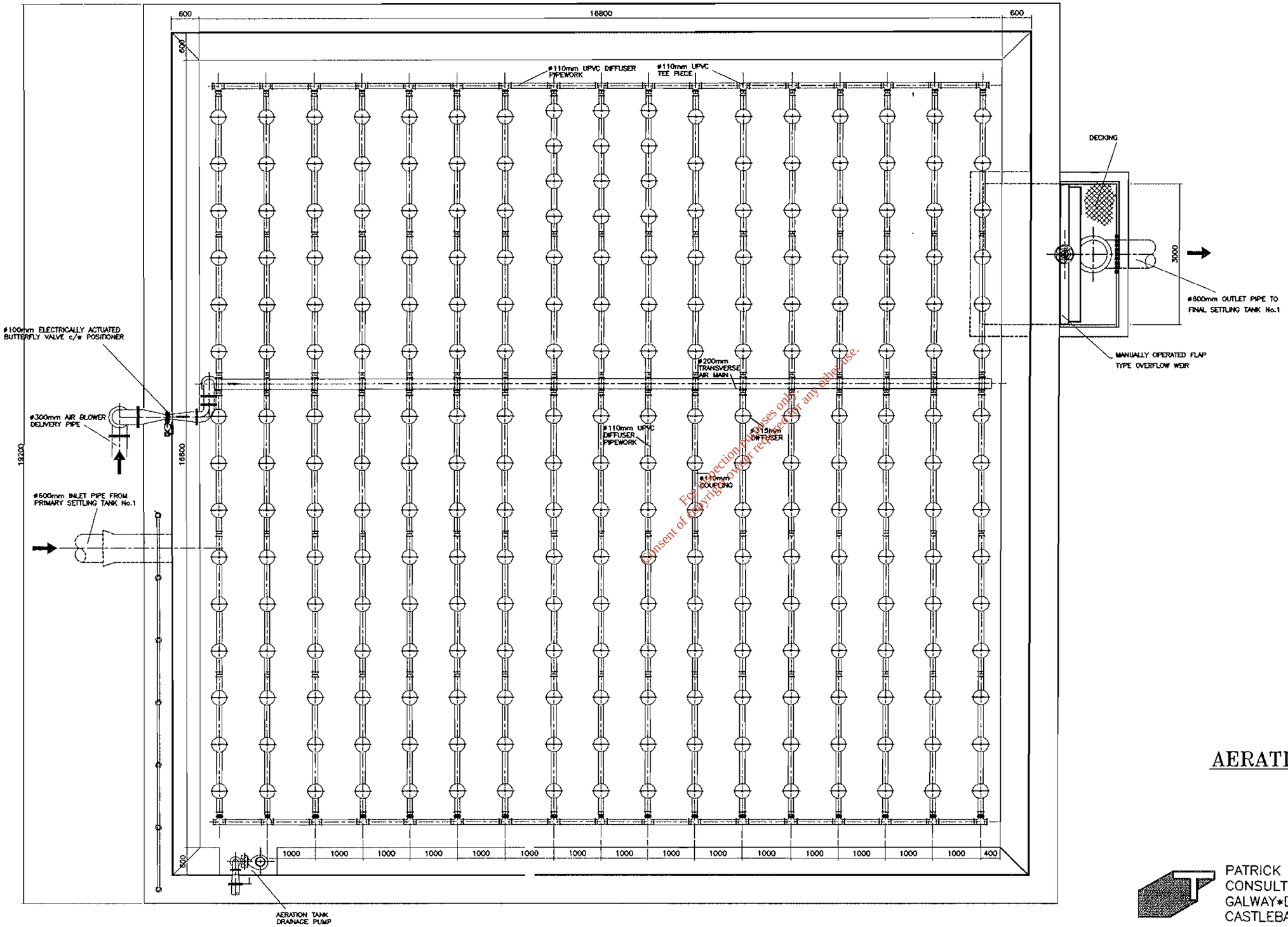




PRELIMINARY UNITS

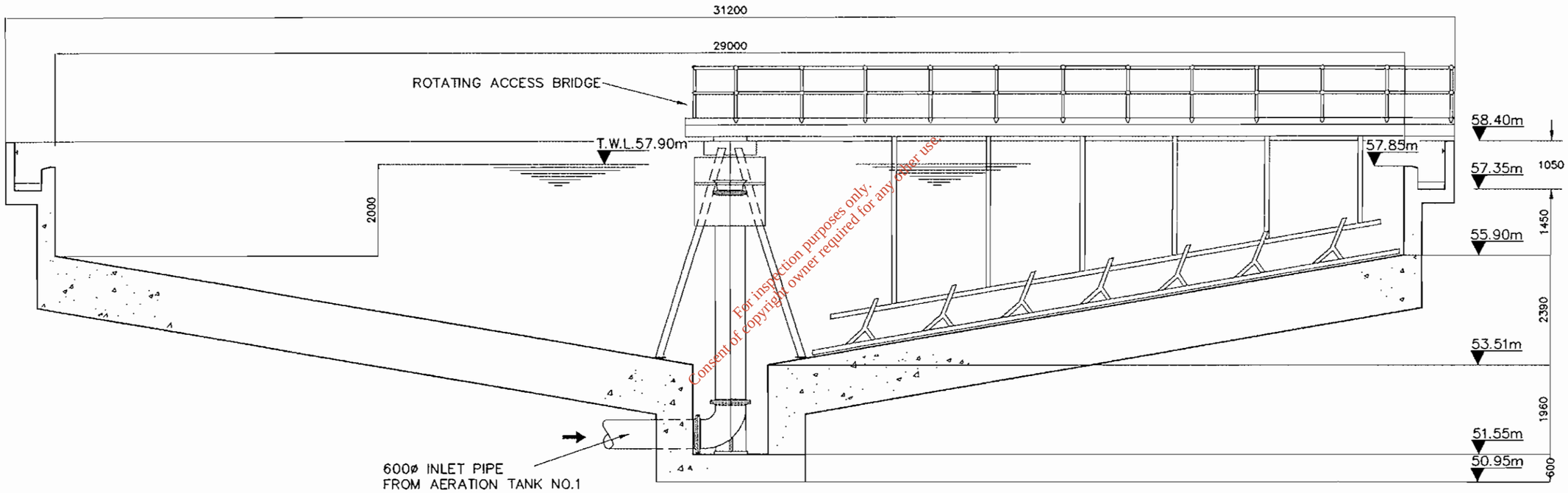
PATRICK J. TOBIN & CO. LTD.
CONSULTING ENGINEERS
GALWAY*DUNDALK
CASTLEBAR*LIMERICK

MONAGHAN WASTE WATER TREATMENT WORKS



AERATION TANK NO.1

PATRICK J. TOBIN & CO. LTD.
CONSULTING ENGINEERS
GALWAY*DUNDALK
CASTLEBAR*LIMERICK

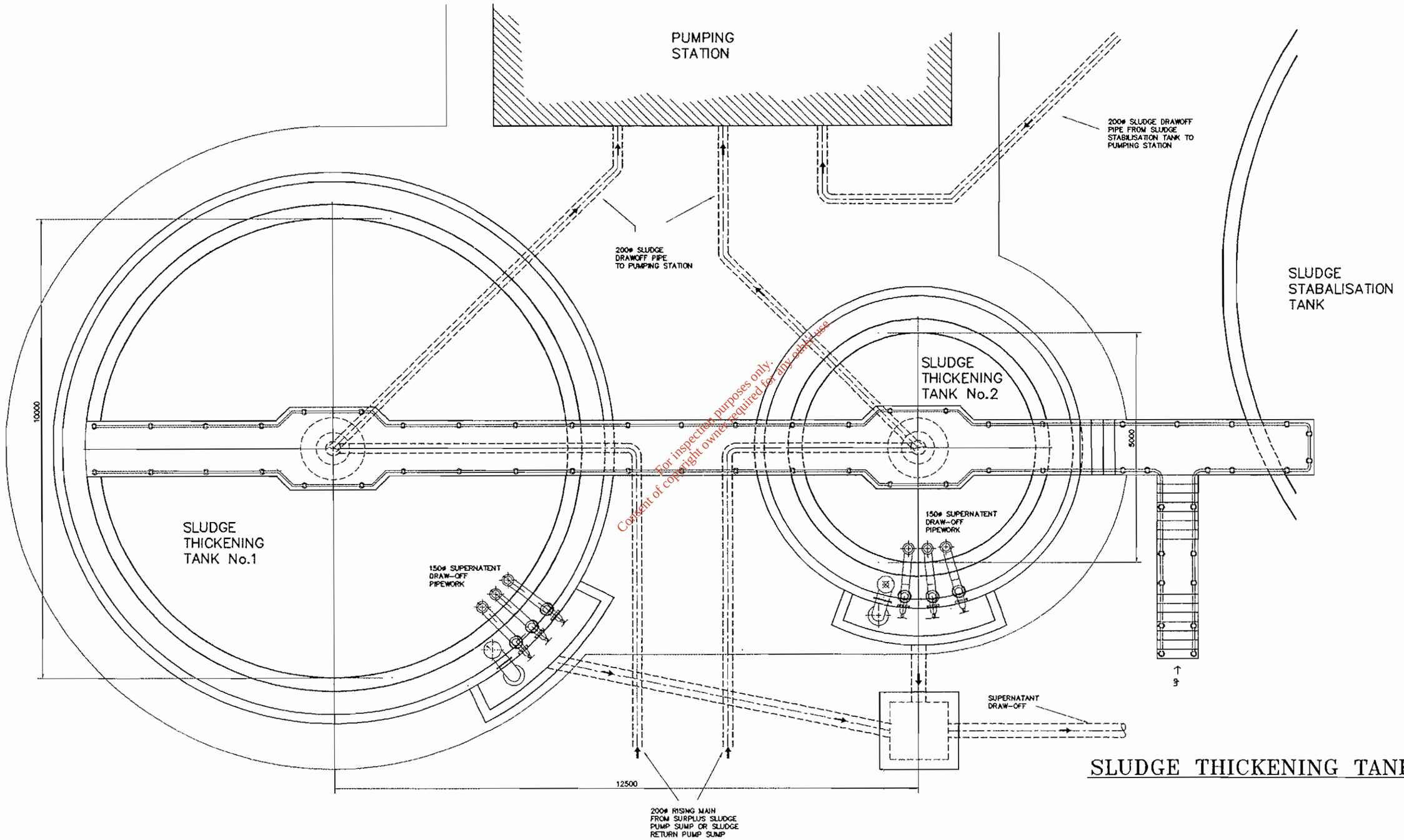


SECTION THROUGH FINAL SETTLING TANK

FINAL SETTLING TANK

PATRICK J. TOBIN & CO. LTD.
CONSULTING ENGINEERS
GALWAY*DUNDALK
CASTLEBAR*LIMERICK

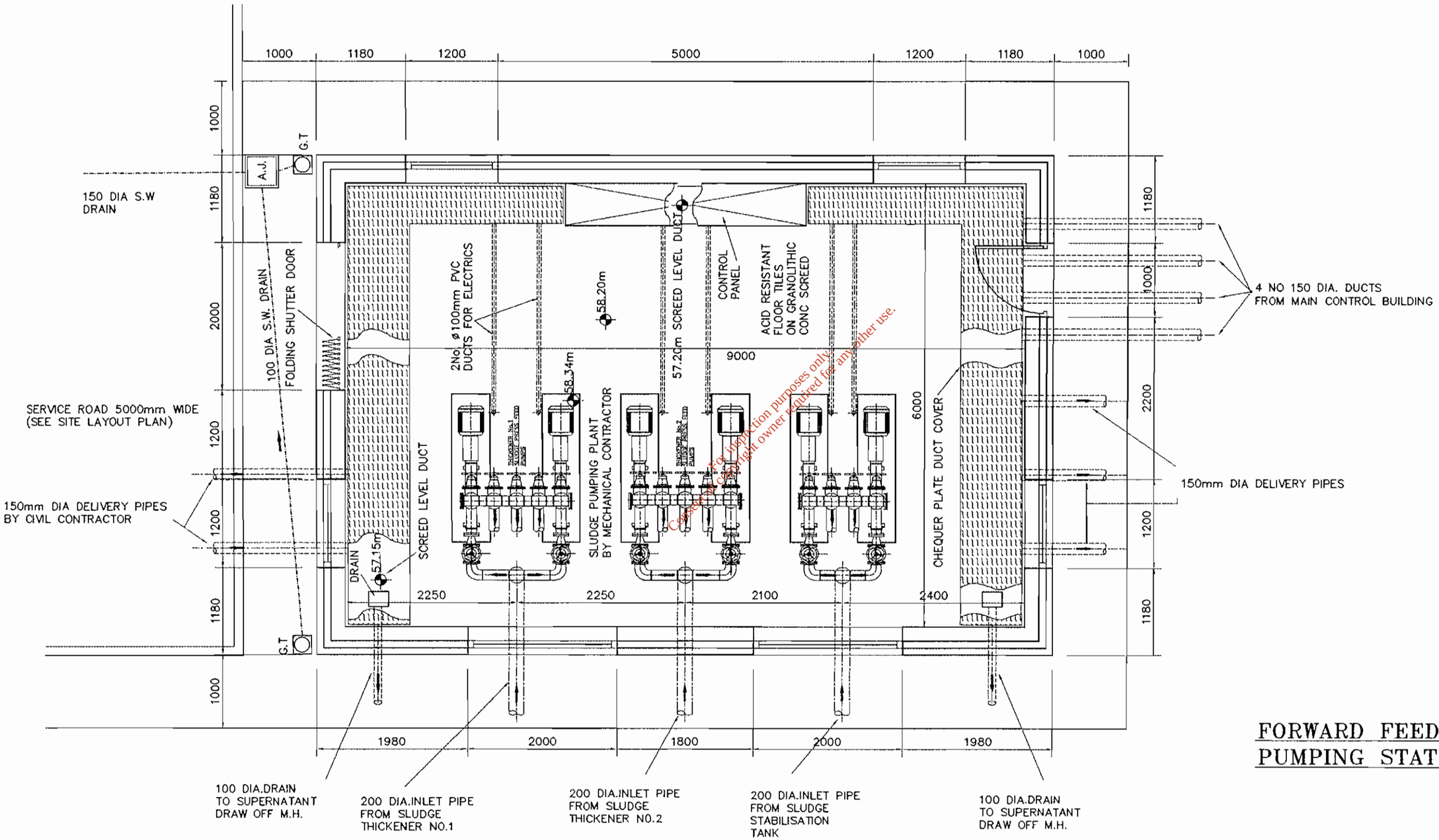
MONAGHAN WASTE WATER TREATMENT WORKS



SLUDGE THICKENING TANKS

PATRICK J. TOBIN & CO. LTD.
CONSULTING ENGINEERS
GALWAY*DUNDALK
CASTLEBAR*LIMERICK

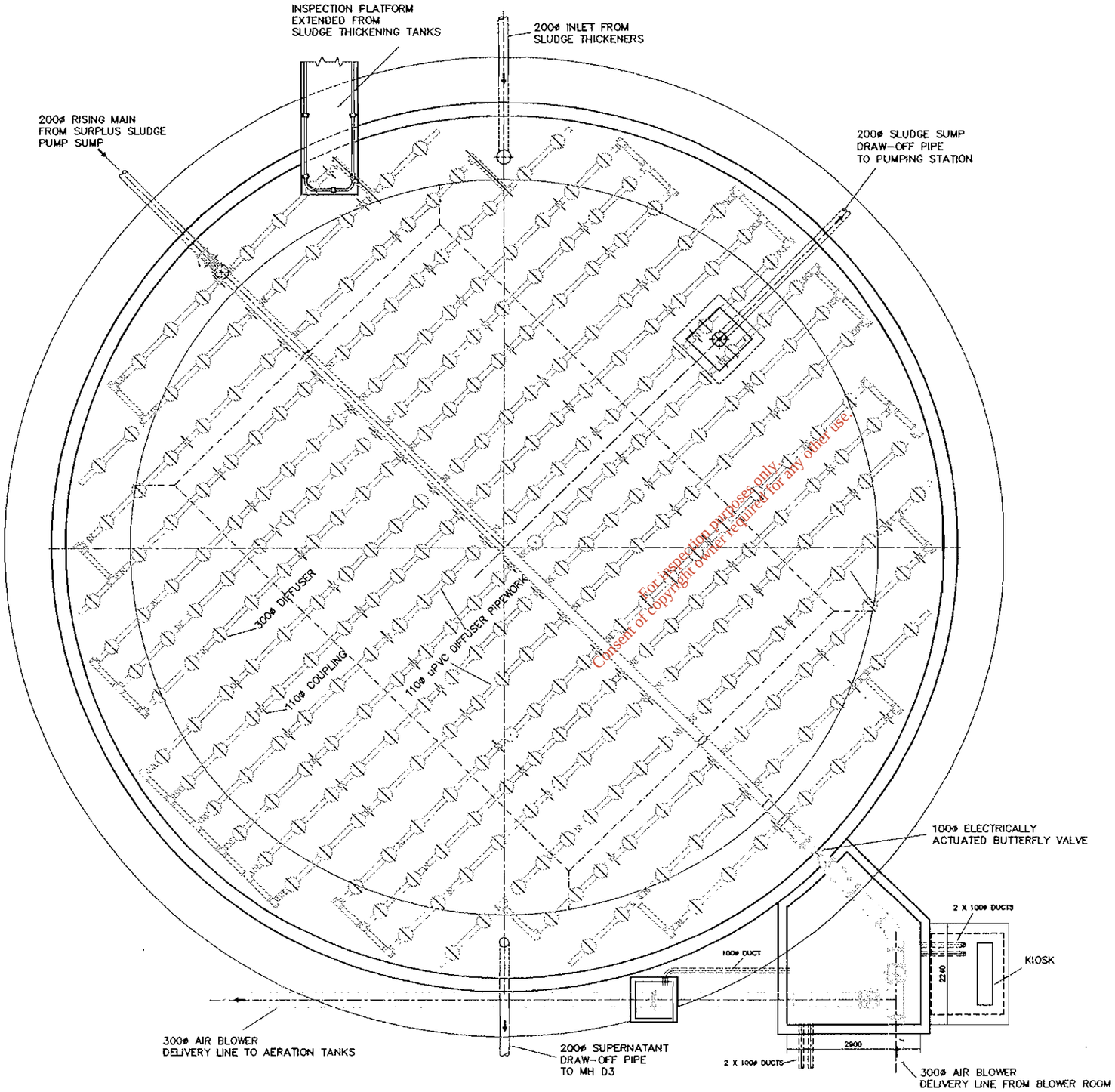
MONAGHAN WASTE WATER TREATMENT WORKS



FORWARD FEED SLUDGE PUMPING STATION

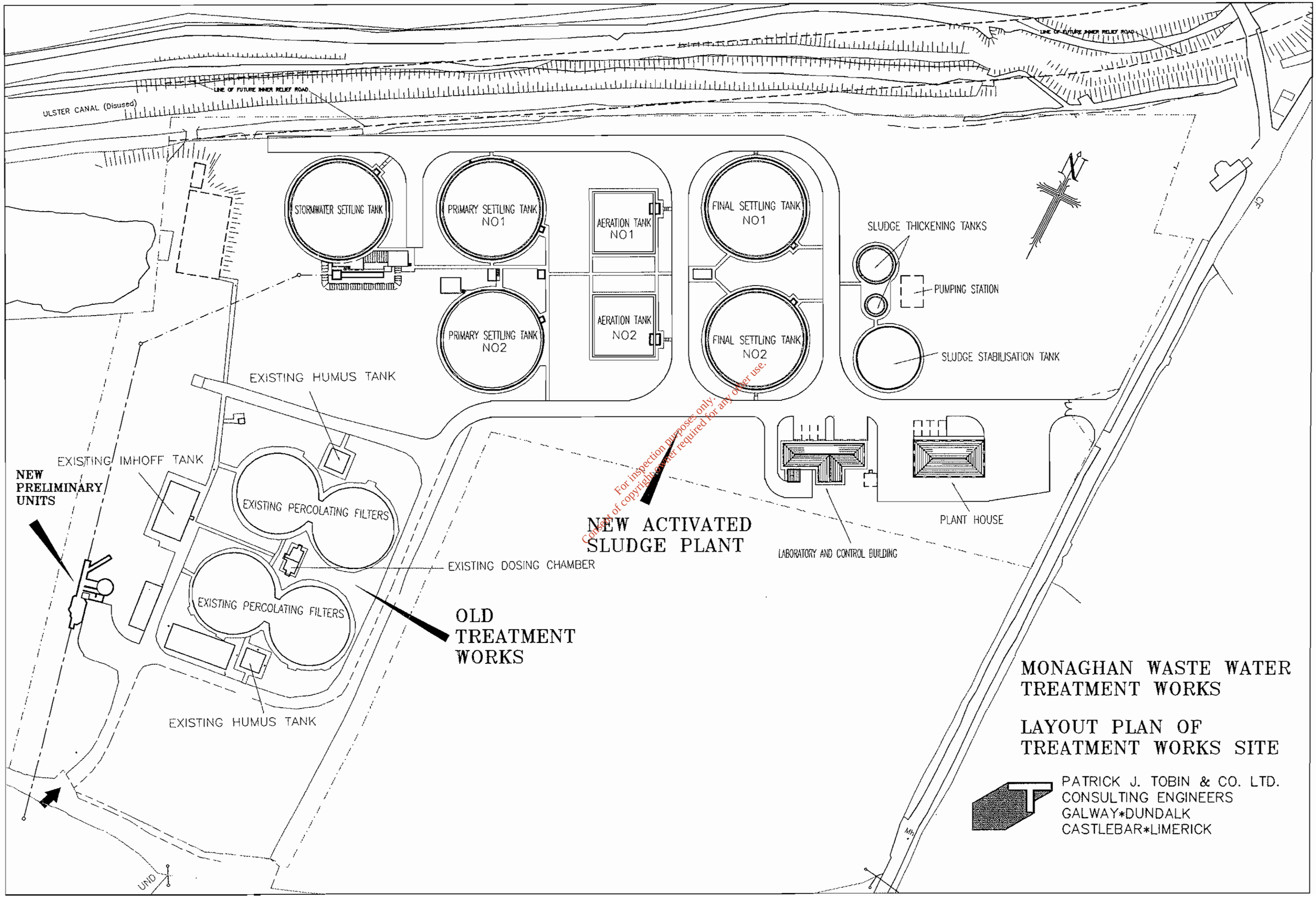
PATRICK J. TOBIN & CO. LTD.
CONSULTING ENGINEERS
GALWAY*DUNDALK
CASTLEBAR*LIMERICK

MONAGHAN WASTE WATER TREATMENT WORKS

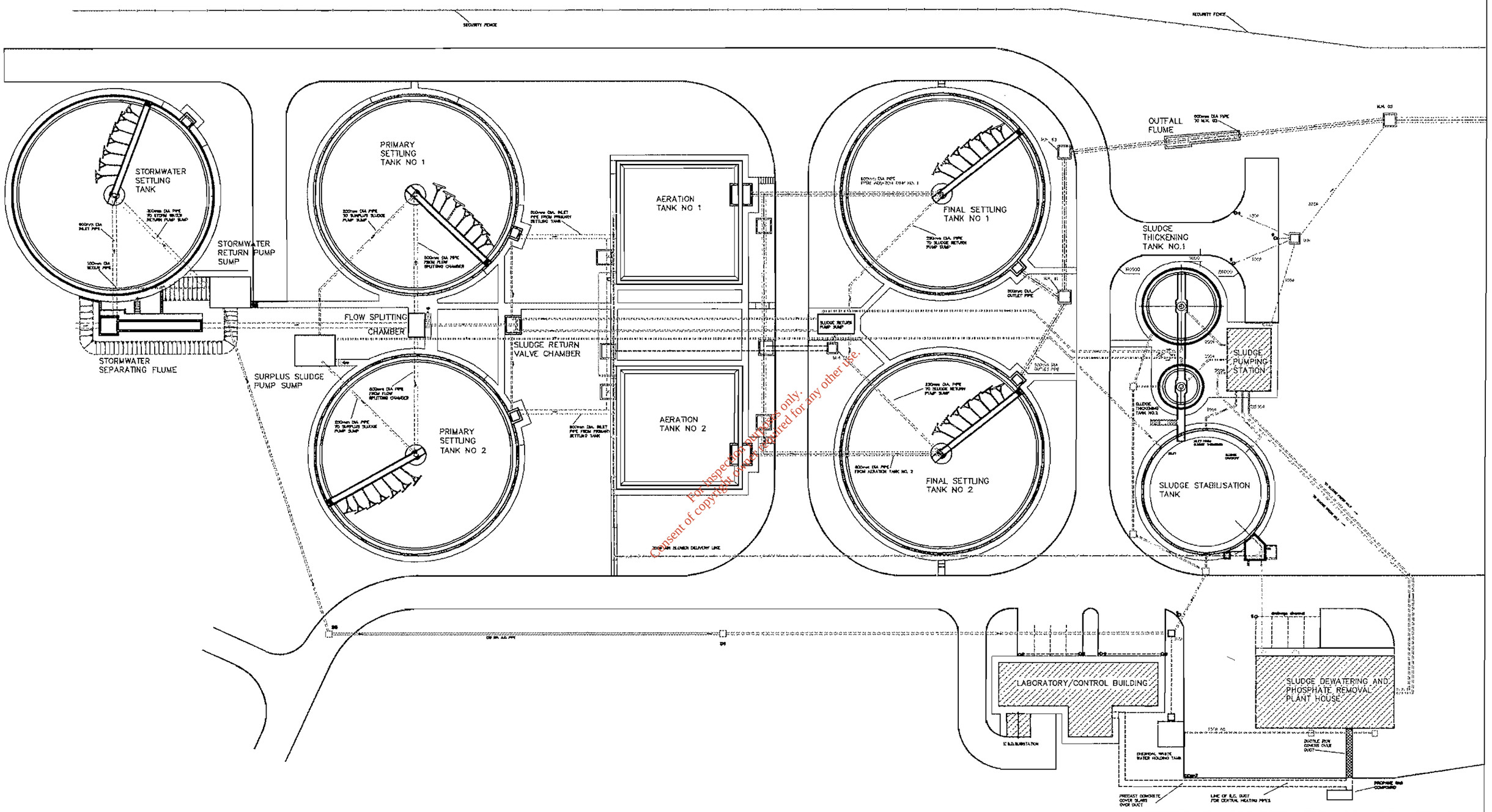


SLUDGE STABILISATION TANK

PATRICK J. TOBIN & CO. LTD.
CONSULTING ENGINEERS
GALWAY*DUNDALK
CASTLEBAR*LIMERICK



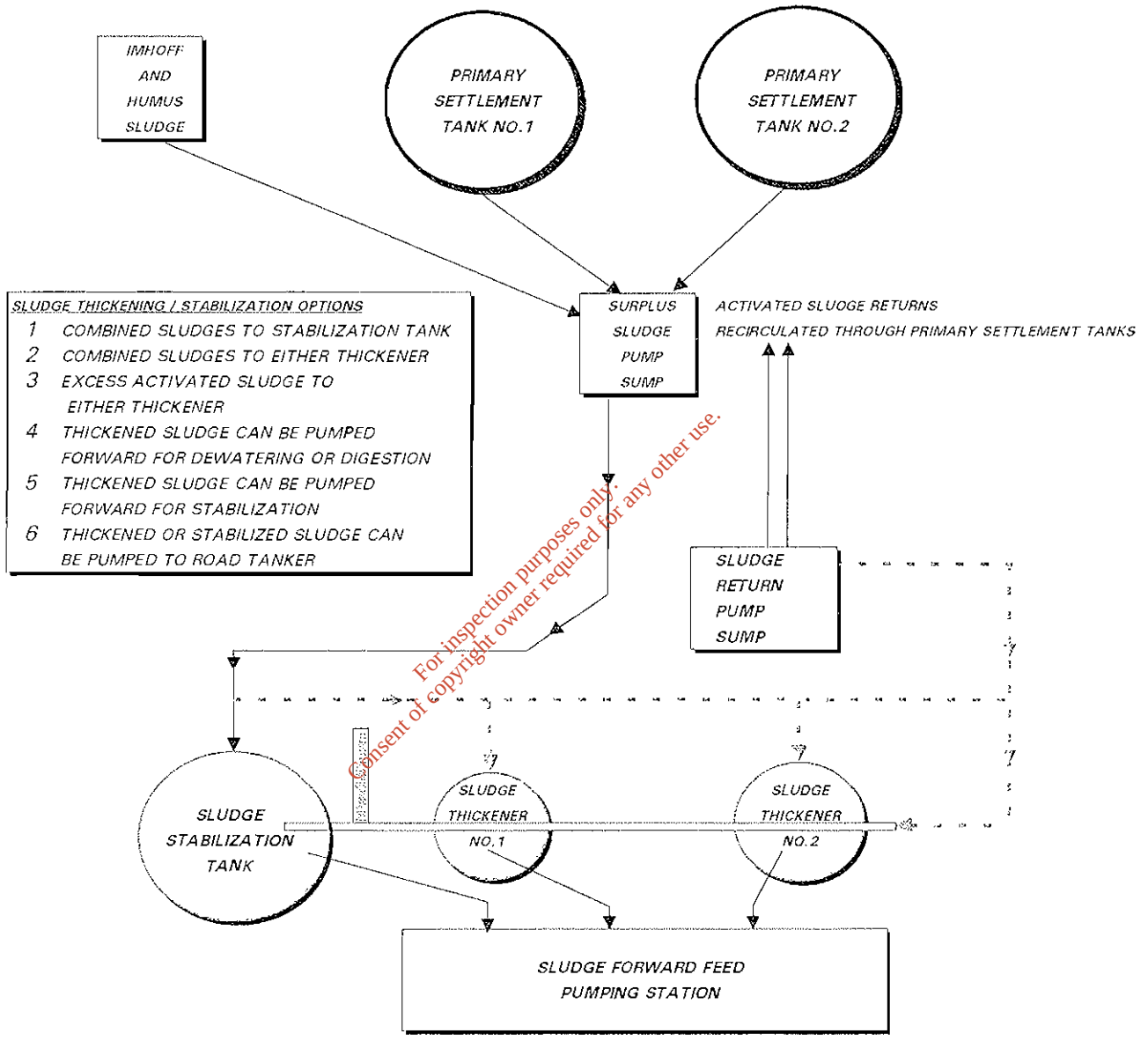
MONAGHAN WASTE WATER TREATMENT WORKS



SITE LAYOUT PLAN OF THE NEW TREATMENT WORKS

PATRICK J. TOBIN & CO. LTD.
CONSULTING ENGINEERS
GALWAY*DUNDALK
CASTLEBAR*LIMERICK

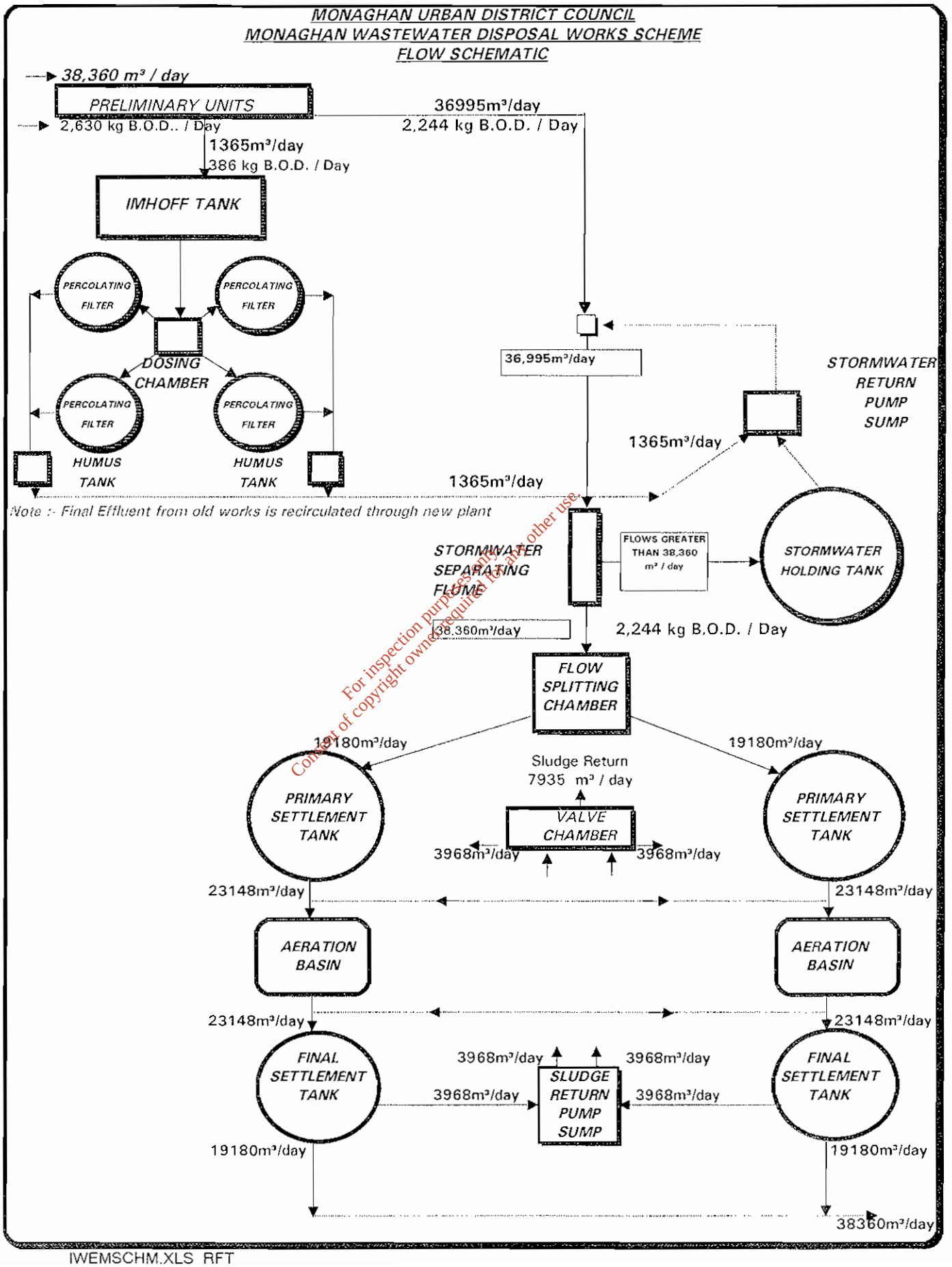
MONAGHAN URBAN DISTRICT COUNCIL
MONAGHAN WASTEWATER DISPOSAL WORKS SCHEME
SLUDGE HANDLING OPTIONS



PUMPING OPTIONS

FROM/TO	STABILISATION TANK	SLUDGE PRESS NO.1	SLUDGE PRESS NO.2(FUTURE)	TANKER CONNECTION	SLUDGE DIGESTER
STABILISATION TANK	NO	YES	YES	YES	YES
THICKENER NO.1	YES	YES	YES	YES	YES
THICKENER NO.2	YES	YES	YES	YES	YES

IWEM\OPT A1 3.RFT



IWEMSCHM.XLS RFT

APPENDIX NO. 2

Schedule of Contractors, Sub-Contractors and Suppliers

SCHEDULE OF MAIN CONTRACTORS, SUB-CONTRACTORS AND SUPPLIERS

A. CIVIL ENGINEERING WORKS CONTRACTORS

P.J. Walls (Civil) Ltd.,
Rosemount Office Park,
Glandore Road,
Dublin 9
Director in Charge: Mr. E. Corcoran
Site Engineer: Mr. J. Hennessy

Main Sub-Contractors
Broomfield Construction, Castleblaney

Ready Mix Concrete
Wright Bros., Cavan Cross, Monaghan

Piling Sub-Contractors
Lowry McKinney

Aluminium Windows and Doors
Oriel Windows Ltd., Old Cross Square, Monaghan

Landscape Architects
Brady Shipman Martin

Landscaping Contractor
Mr. Paul Loughran

B. MECHANICAL/ELECTRICAL PLANT CONTRACTORS

Jones Environmental (Ireland) Ltd.,
Richview,
Clonskeagh,
Dublin 14
Director in Charge: Mr. B. Fenton
Contract Manager: Mr. B. Sheill

Fabrication Sub-Contractors

Russel Metal Fabrication - Mr. Charlie Russel
and
Ballinphellic Engineering Ltd.

Electrical Control Panels

EEC Control Panels, Castleblaney

Electrical Sub-Contractor

Byrne Electrical, Mr. Seamus Byrne

Mimic Diagram

Shee Process Displays, Mr. John Sheedy

Sludge Dewatering Equipment

Solids Technology Ltd.

Laboratory Furniture

A.R. Cameron Ltd, Mr. C. Cameron

Telemetry System

Jones Environmental (Ireland) Ltd.

COMHAIRLE BHAILE CHEANNTAIR MHUINEACHAIN
Monaghan Urban District Council

MONAGHAN WASTEWATER TREATMENT WORKS

Officially opened by

Mr. MICHAEL SMITH T.D.

Minister for the Environment

22nd April 1994

DEPARTMENT OF THE ENVIRONMENT

INTRODUCTION

The Town of Monaghan was, until the introduction of the new Treatment Works, served by a Sewage Treatment Plant which comprised coarse screening, an Imhoff tank, 4 No. Percolating Filters and 2 No. Humus Tanks. This Plant was constructed in the early 1970's but with the increase of population in the Town of Monaghan allied to the growth of industry in the area, the existing facilities became both hydraulically and biologically overloaded.

The new Treatment Works has been designed with a view to providing a modern disposal works for Monaghan Town, adequate to cater for the projected requirements to the year 2014 AD.

The present design includes for retention of the old works which is now operating at a level of duty more in keeping with the original design, working alongside the new Treatment Works to provide a system of treatment and disposal of wastewater from the Town of Monaghan and its Environs. The Works has been constructed on a site in the Townland of Tirkeenan and is located to the southeast of Monaghan Town with access from the Monaghan to Dublin Road (N2). The treated effluent from the Works is discharged via an outfall pipeline to the nearby Shambles River which in turn discharges to the Blackwater River north of the Treatment Works Site.

KEY DATES

Tenders for the Scheme were received in December, 1990 and Department of the Environment approval to proceed was obtained in June, 1991. The Civil Contractor, P.J. Walls (Civil) Ltd. commenced on site in August of 1991 and the Plant Contractor, Jones Environmental (Irl) Ltd. commenced in May, 1992. Civil Engineering Works had been substantially completed by Easter of 1993, followed by substantial completion of the Mechanical Plant installation by the end of November, 1993.

WASTEWATER TREATMENT PLANT CIVIL ENGINEERING WORKS

The main Civil Engineering Works Contractor, P.J. Walls (Civil) Ltd. carried out a difficult task of constructing major tanks and structures on a site where ground conditions were extremely difficult. Site investigations revealed variable underground conditions of sand and silt at variable depths. In one area, the soft silt extended to 10m below ground level. Limestone rock was encountered generally 9m to 10m below ground level although it varied considerably across the site. High ground water levels were encountered and the use of piles was anticipated as necessary for support of the Primary Settlement Tanks and the Aeration Basins. In the construction of tanks and buildings for the Wastewater Treatment Plant, approximately 6,000cu.m. of concrete was placed. The Civil Engineering Works Contract included for the construction of -

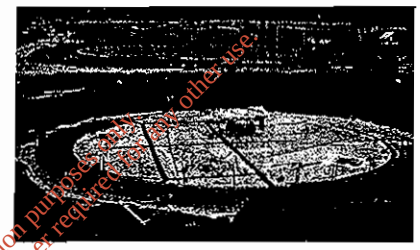
a) Preliminary Units.
b) Stormwater separating flume with flow splitting chamber.
c) 1 No. Stormwater Tank 29m diameter.
d) 2 No. Primary Settling Tanks, each 29m diameter.
e) 2 No. Aeration Tanks each 18m x 18m x 4.75m liquid depth.
f) 2 No. Final Settling Tanks, each 29m diameter.
g) 1 No. Sludge Stabilisation Tank, 19m diameter.
h) 2 No. Sludge Thickeners (5m and 10m diameter).
i) Stormwater Return Pump Sump.
j) Surplus Sludge Pump Sump.
k) Sludge Return Pump Sump.
l) Sludge Dewatering/Ferric Sulphate Dosing/Air Blower Plant House.
m) Sludge Forward Feed Pumping Station.
n) Laboratory/Control Building.
o) Refurbishment of the existing works.

The Civil Engineering Works Contract also included for ductile iron interconnecting pipework ranging from 200mm diameter to 900mm diameter, and subsequent site development included site preparation, roads, paths, embankments, palisade fencing and landscaping. The Contract also included for a comprehensive CCTV survey of the existing Town Sewerage System with reconstruction of some sections of sewers and repair by partly lining to seal structural damage to existing pipes in the main streets.

Labour on site at commencement was about 10 persons but this increased to 45 persons (20 skilled) at peak times.

DESCRIPTION OF WASTEWATER TREATMENT PROCESSES

The flow entering the works is screened and degritted and is divided into two streams of treatment. The first stream of treatment directs flow to the old Treatment Works. The old Works will take flows up to 1,365m³ per day, with all other flows being diverted to the second stream of the treatment, which is designed to treat all flows within the range of 1,365 to 38,360m³/day. Flows in excess of 38,360m³/day will be discharged to the Stormwater Holding Tank. The second stream of treatment uses the conventional Activated Sludge Treatment Process. It comprises of 2 No. Primary Settling Tanks, 2 No. Aeration Basins, 2 No. Final Settlement Tanks along with the necessary Sludge Return and Sludge Wastage facilities normally associated with such a Plant. The surplus sludge from the Plant will be thickened, stabilised and dewatered.



The works also contains a facility for the removal of phosphates by means of chemical precipitation.

A significant design feature at the Monaghan Wastewater Treatment Plant is the incorporation of a Fine Bubble Diffused Aeration system both in the Aeration Basins and in the Sludge Stabilisation Tank. Oxygen transfer efficiencies of 3.5kg O_2/kwh were achieved under standard test conditions during December of 1993. This system is considerably more energy efficient than conventional surface aeration systems. Compressed air for this system is provided by means of 2 No. HV turbo centrifugal blowers. The running speed of the units is automatically controlled in response to the dissolved oxygen level measured in the Aeration Basins.

INSTRUMENTATION CONTROL AND AUTOMATION

A comprehensive range of instrumentation has been installed to monitor, power consumption, dissolved oxygen levels, process flow rates, sump levels, bulk storage tank levels and final effluent phosphate level. In response to the requirements of the Urban Wastewater Directive, the works is also equipped with a continuous sampling device at the Final Effluent Chamber so that composite 24 hour samples can be taken on a flow or time proportional basis.

The overall operation and control of the Plant is carried out through a PLC (Programmable Logic Controller). The PLC controls the following automatic sequences -

1. Pro-rata division of flows between the old Works and the New Activated Sludge Plant.
2. Automatic control of degritting operations.
3. Automatic control of the Turbo Blowers .
4. Control of Stormwater Return Pumping Equipment.
5. Automatic control of Submersible Pumping Equipment.
6. Monitoring of Bulk Chemical Storage Facilities.
7. Control of Sludge Return/Sludge Wastage Valves.

The Telemetry System allows for current status graphical displays of all major Plant items and includes alarms, level controls, maintenance programme monitoring and data storage. A comprehensive trending capacity for stored data is also included.

TECHNICAL DATA

PLANT LOADINGS

DRY WEATHER FLOW

10,000 Persons @ 250 litres / head / day	=	2,500 m³ / Day
Industrial Flow Allowance	=	6,800 m³ / Day
Total Dry Weather Flow	=	9,300 m³ / Day
Maximum Flow for Full Treatment	=	38,360 m³ / Day

ORGANIC LOADING

Total B.O.D. Load	=	2,630 kg B.O.D. / Day
B.O.D. Load to Old Works	=	386 kg B.O.D / Day
B.O.D. Load to New Activated Sludge Plant	=	2,244 kg B.O.D. / Day

DIVISION OF DRY WEATHER FLOW (9,300 m³/ Day)

Flow to Old Treatment Works	=	1,365 m³/ Day
Flow to New Activated Sludge Plant	=	7,935 m³/ Day

FINAL EFFLUENT STANDARD

B.O.D.	10 to 20 mg / l
Suspended Solids	20 to 30 mg / l

FLOWS IN EXCESS OF 9,300 m³/ Day AND UP TO 38,360 m³/ Day

Flow to Old Treatment Works	=	1,365 m³/ Day
Flow to New Activated Sludge Plant	=	36,995 m³/ Day

PRELIMINARY UNITS

Solids Removal Units	2 No. Jones and Attwood Vertical Drum Screens Model No. 450SL (@ 480 l / s) with 5mm Slots
Solids Disposal	2 No. Jones and Attwood Screw Compactors Model No. J & A 200 (0.8m³ / Hour) 1 No. Covered Skip
Grit Removal	1 No. Jones & Attwood Standard Grit Classifier 1 No. Covered Skip
Flow Separation	Measurement Flume and Automatically Controlled Penstock (1,365 m³ / Day to Old Works, Balance of Flow to New Works)

STORMWATER HOLDING TANK

Quantity	1 No.
Volume	2,270 m³
Retention Time @ D.W.F.	5.9 hours
Stormwater Return Pumps	2 No. @ 70 l / sec Vs 8.5 m Head
Stormwater Tank Emptying Time	9 hours

PRIMARY SETTLEMENT TANKS

Quantity	2 No.
Surface Area per Unit	660.5 m²
Volume	1,877 m³
Retention Time @ D.W.F.	9.7 hours
Retention Time at Maximum Flow	2.4 hours
B.O.D. Removal Efficiency	35%

AERATION BASINS

Volume per Basin	1,539 m³
Aeration System	Completely Mixed
Method of Aeration	Fine Bubble Diffused Aeration System using H.V. Turbo Blowers
Retention Time @ D.W.F.	9.31 hours
Retention Time @ Max. Flow	1.93 hours
MLSS Concentration	2,000 to 4,000 mg / l
F/M Ratio	0.15 kg B.O.D. / d Applied / kg MLSS
Organic Loading Rate	0.44 kg B.O.D. / m³.d
Blower Efficiency (From 50% to 100% Duty)	76.2% to 80.5%
Diffuser System Designers	Jones Environmental (Ireland) Ltd.
Overall Diffuser System Manufacturer	Water Engineering in Association with G.V.A. (Germany)

FINAL SETTLEMENT TANKS

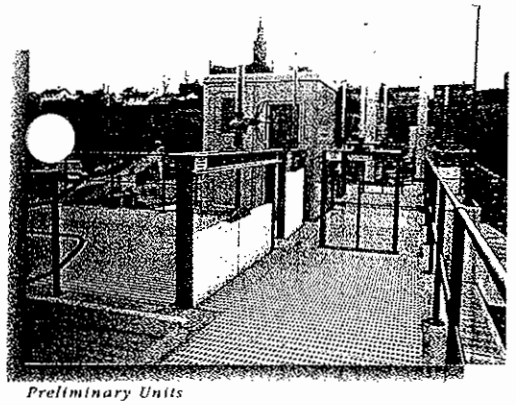
Surface Area per Unit	660.5 m²
Volume per Tank	1,877 m³
Surface Loading Rate	32.04 m³ / m / day
Weir Overflow Rate	232.3 m³ / m / day
Retention Time at Maximum Flow	2.13 hours

SLUDGE HANDLING FACILITIES

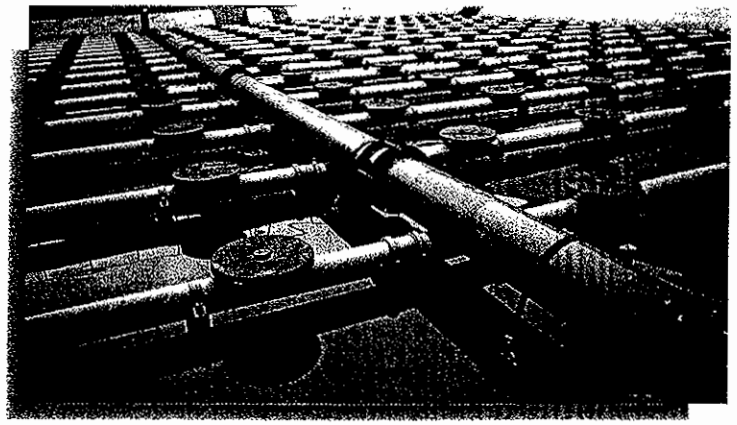
Sludge Thickening	2 No. Thickeners @ 5 m and 10 m Diameter
Sludge Stabilisation	1 No. Sludge Stabilisation Tank 19 m Diameter Incorporating Fine Bubble Diffused Aeration System
Sludge Dewatering Machine	Solids Technology Ltd. Series 5 Double Belt Press
Dry Solids Content of Dewatered Sludge	18% to 25% Depending on Sludge Combination Selected
Method of Sludge Removal	Sealed Sludge Trailers

ELECTRICAL INSTALLATION

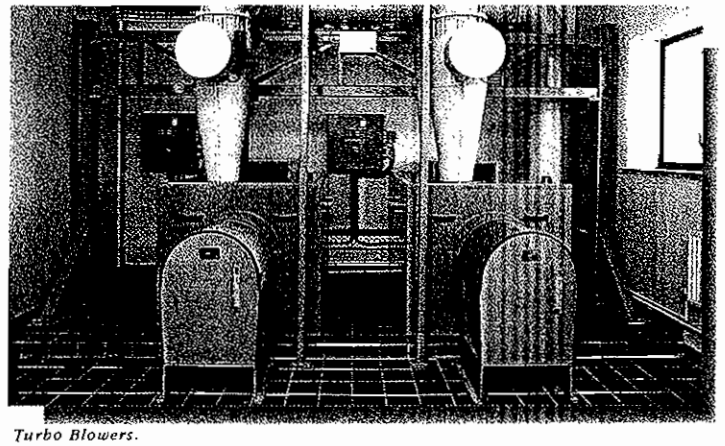
Electrical Zoning	The Sludge Dewatering Plant House is Electrically Zoned to B.S. 5435 and is Fitted with a Gas Detection System
Switchgear	Control Panels are Manufactured to I.E.C. 439 Form IV
Intruder Alarm System	To I.S. 199
Emergency Lighting Installation	To I.S. 3217



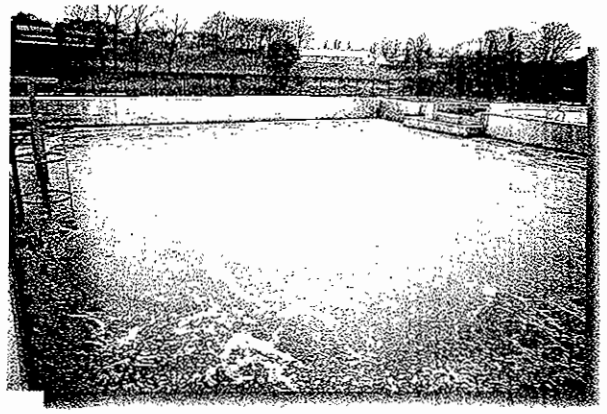
Preliminary Units



Aeration Basin - Empty, Showing Diffusers in Position.

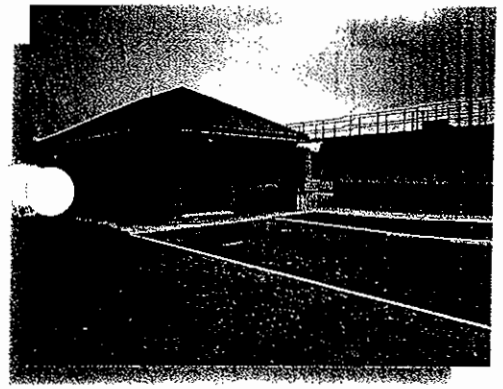


Turbo Blowers.

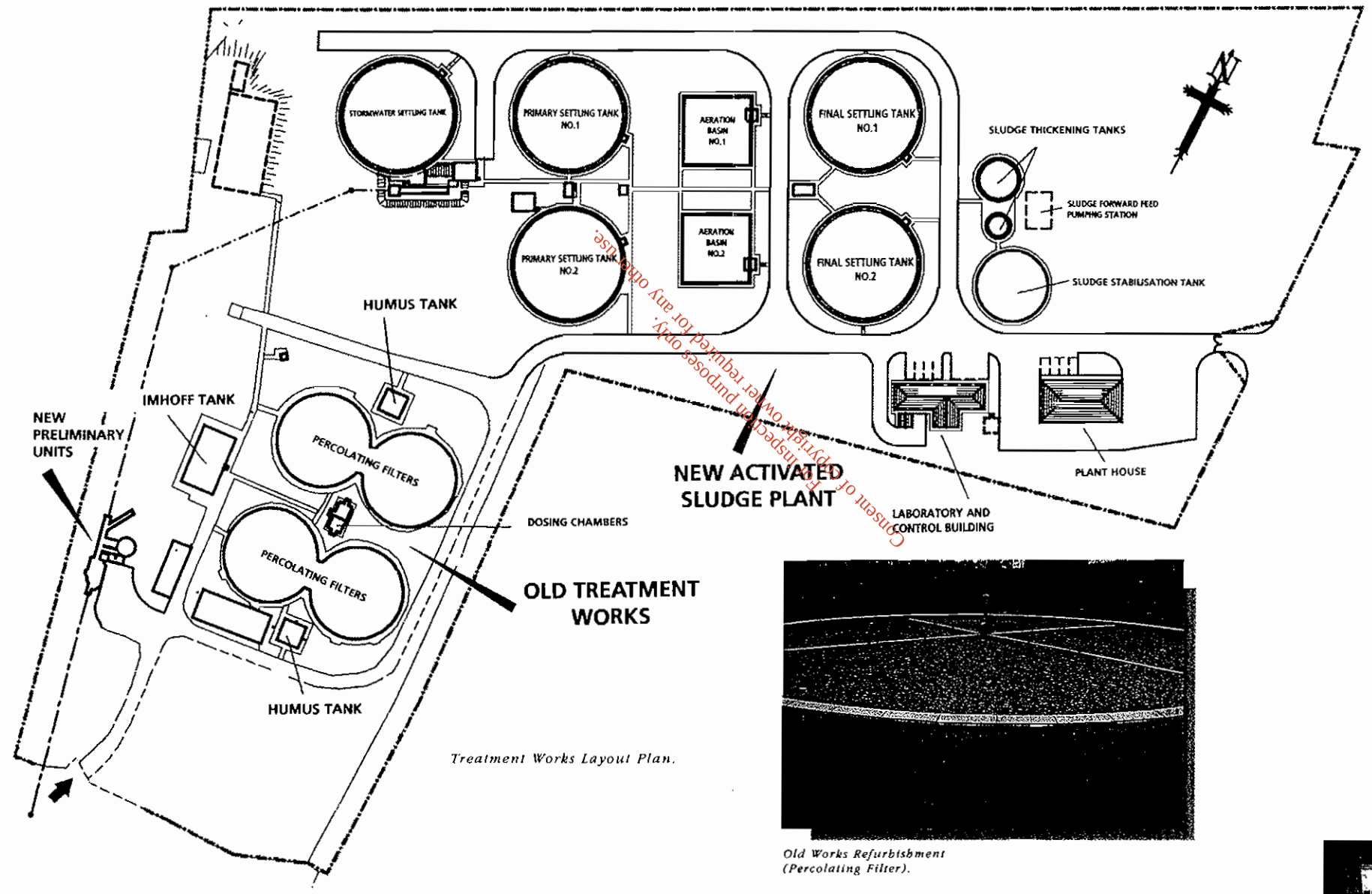


Aeration Basin - Full, Showing Fine Bubble Diffused Aeration System in Operation

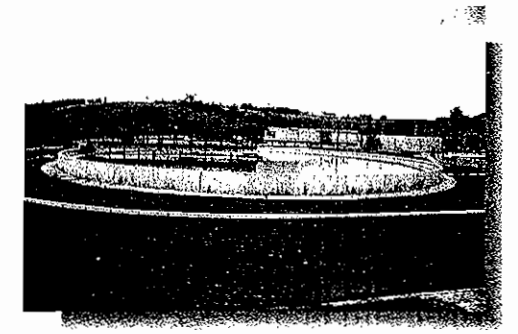
MONAGHAN WASTEWATER TREATMENT WORKS



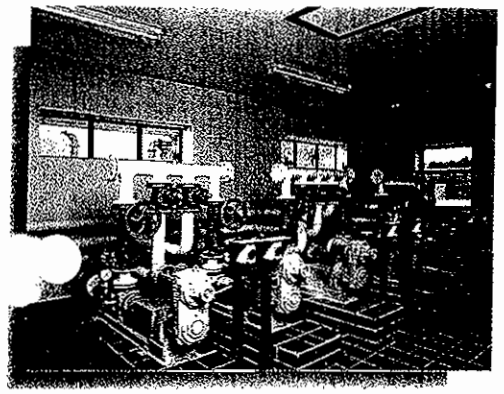
Sludge Forward Feed Pumping Station and Sludge Thickener.



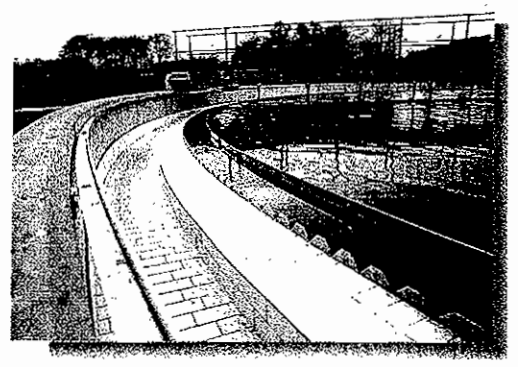
Treatment Works Layout Plan.



Final Settlement Tank, with Thickeners and Stabilisation Tank in the Background

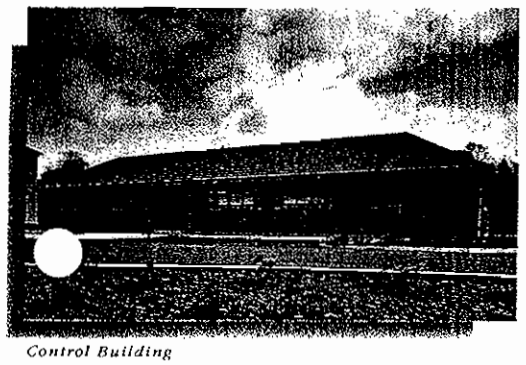


Sludge Forward Feed Pumps



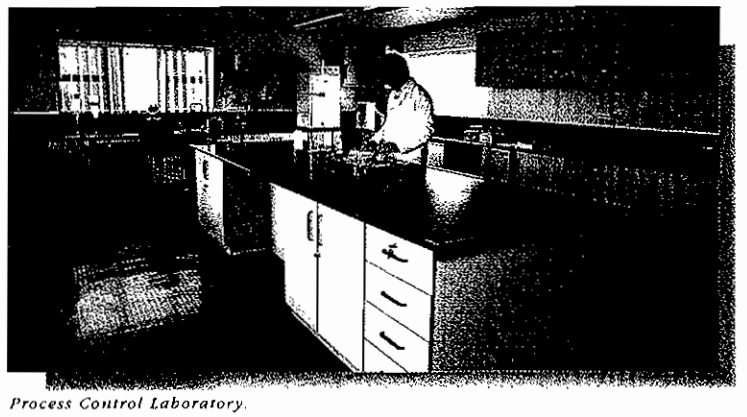
Final Effluent.

Old Works Refurbishment (Percolating Filter).



Control Building

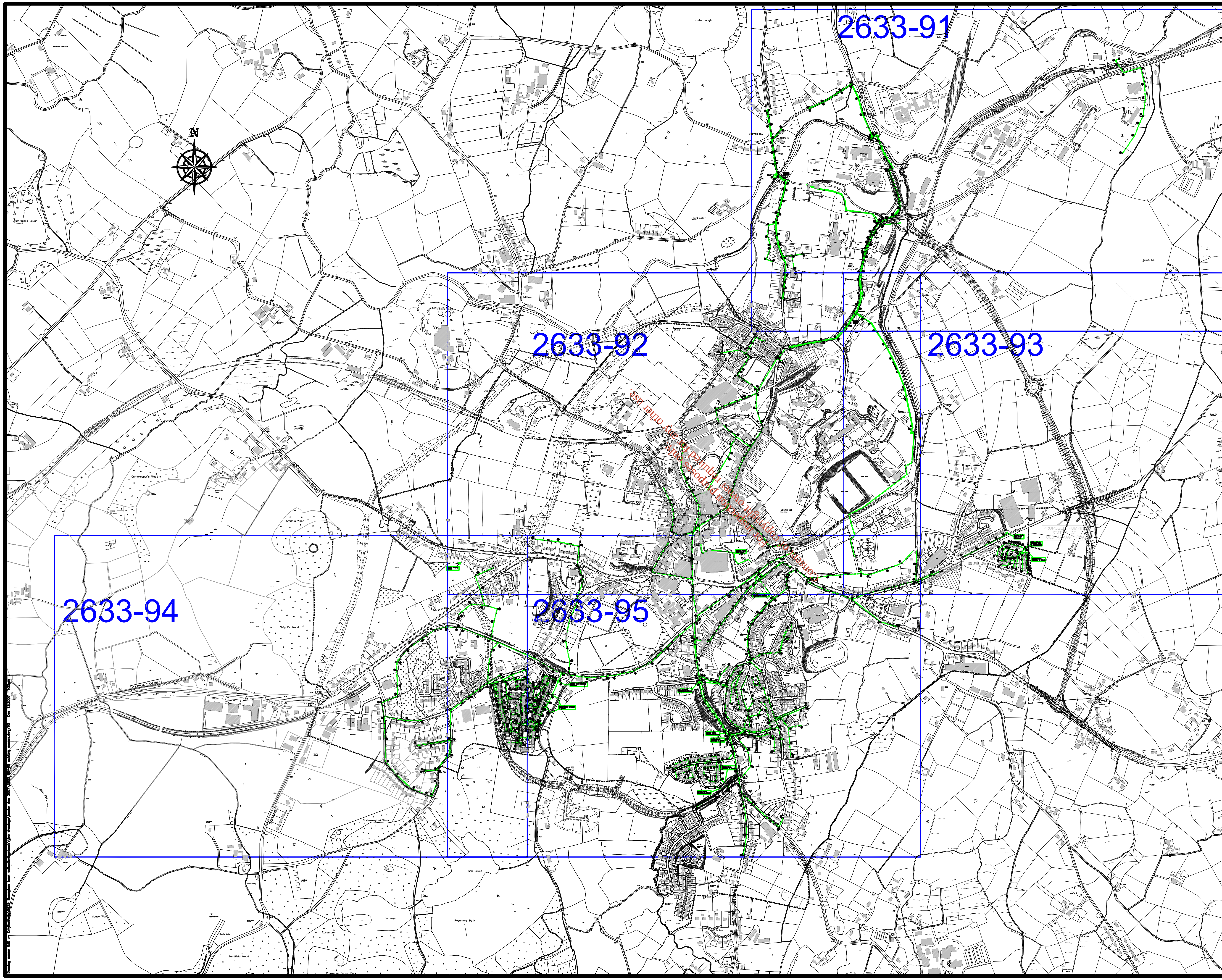
Control Centre



Process Control Laboratory.

Attachment No. C.2

Supporting documentation on the design and construction of any and all discharge outfalls, including stormwater overflows, from the waste water works



UPDATED PRELIMINARY REPORT ISSUE	MAR'07
AMENDMENT DETAILS	**DATE**

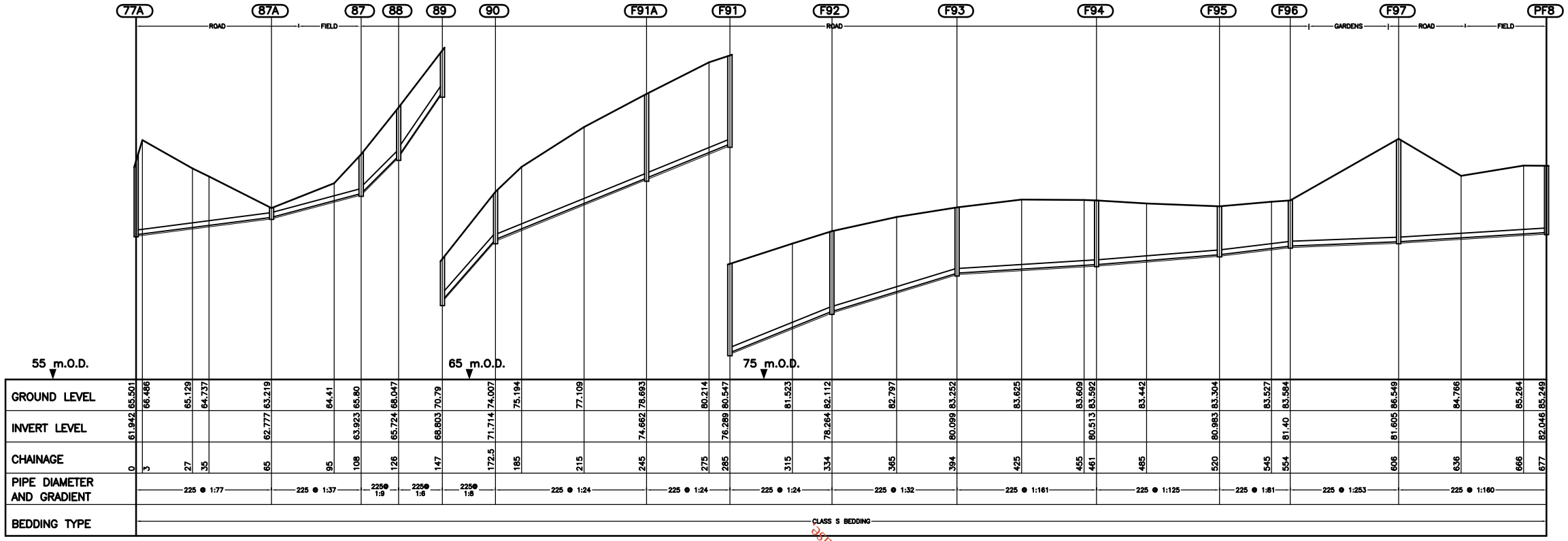
T.J.O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 295 2321 Fax: 295 4541

PROJECT: MONAGHAN TOWN COLLECTION NETWORK

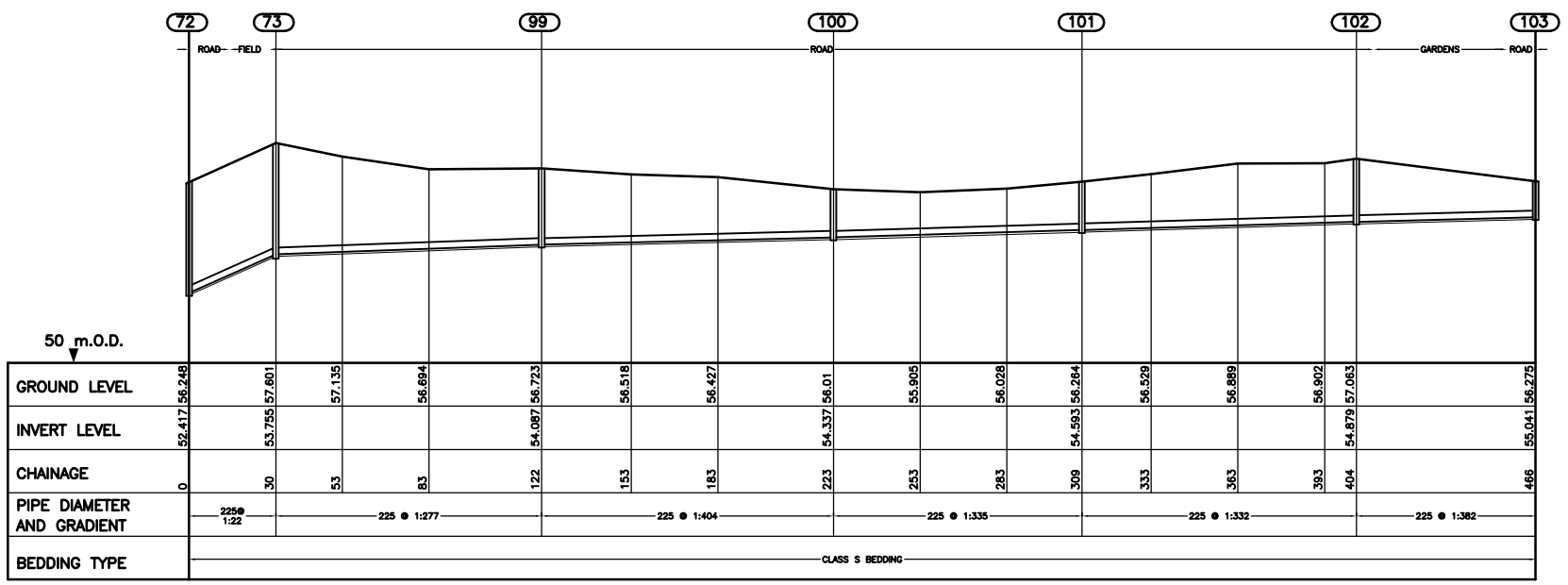
CLIENT: MONAGHAN COUNTY COUNCIL

DRAWING TITLE: KEY PLAN – EXISTING SEWERS

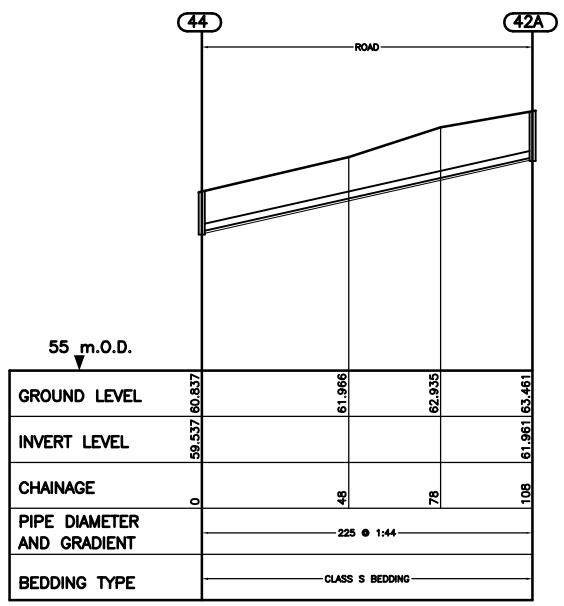
SCALE: 1:7500	**JOB NO:** 2633	**DRAWING NO:** 90
DATE: Apr'06 **DRAWN BY:** GJD		



12 – EXISTING FOUL SEWER – CASTLEBLANEY ROAD TO KILLYGOWAN ESTATE



13 – EXISTING FOUL SEWER – MALL ROAD



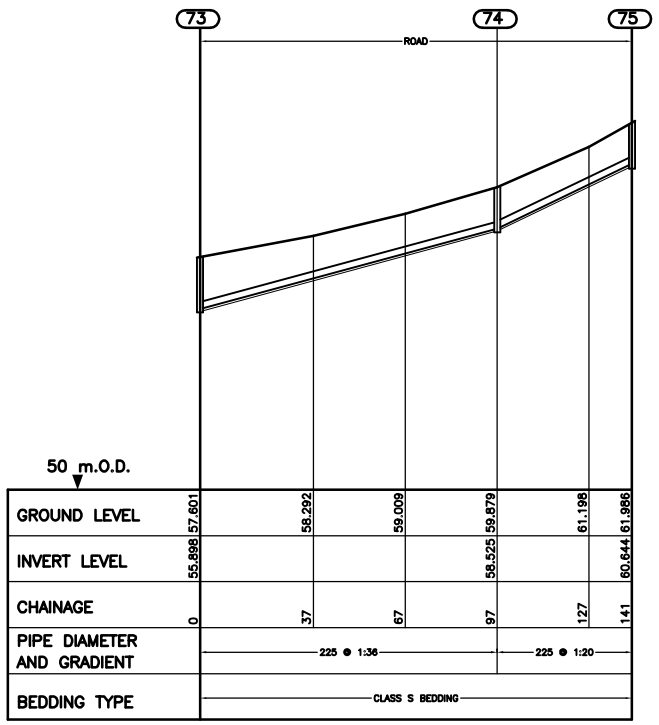
14 – EXISTING FOUL SEWER – GLASSLOUGH STREET

	UPDATED PRELIMINARY REPORT ISSUE	MAR'07
	AMENDMENT DETAILS	DATE

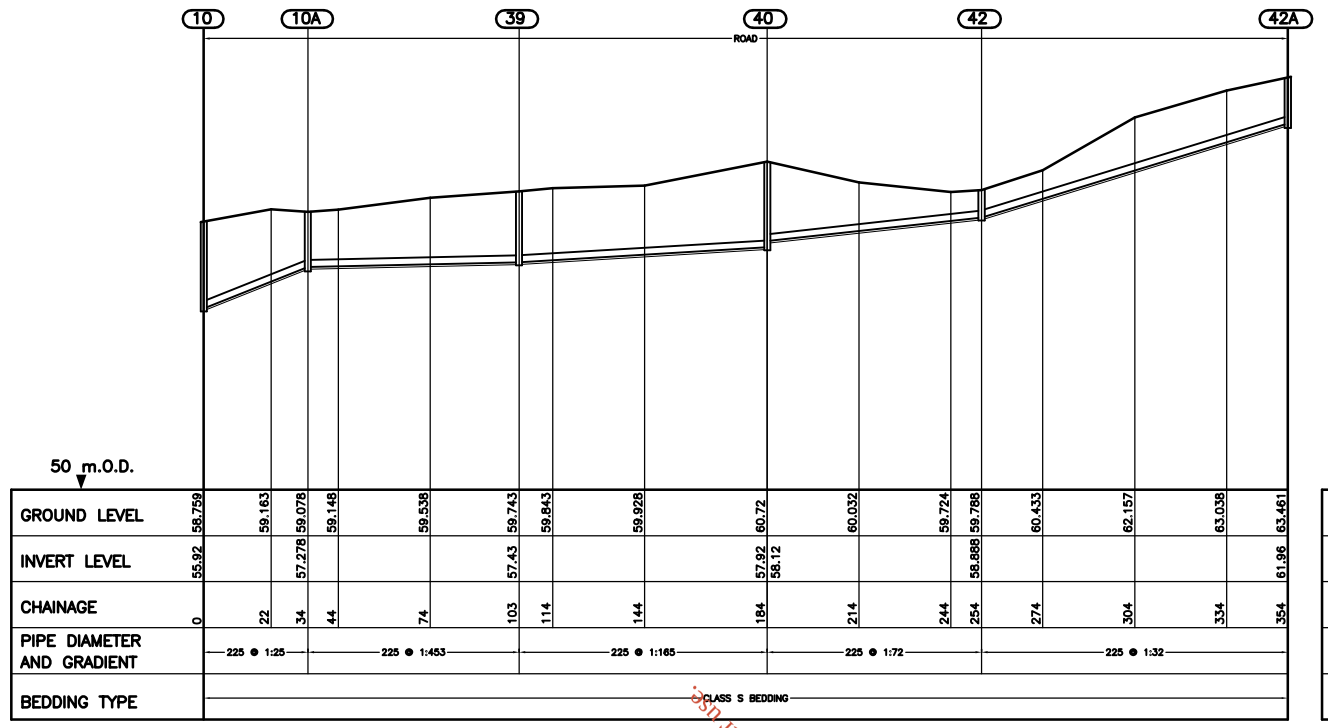
T.J.O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 295 2321 Fax: 295 4541

PROJECT: MONAGHAN TOWN COLLECTION NETWORK
CLIENT: MONAGHAN COUNTY COUNCIL
DRAWING TITLE: EXISTING FOUL SECTIONS – SHEET 6 OF 7

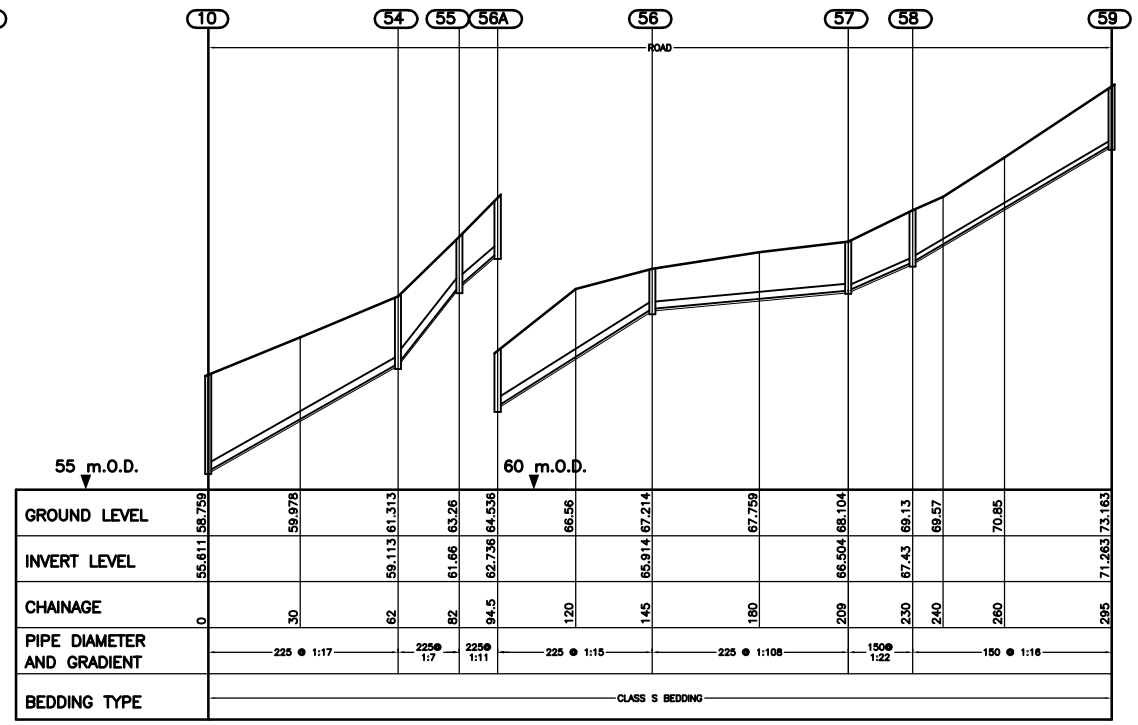
SCALE: 1:1250h, 1:125v		JOB NO: 6322	DRAWING NO: 101
DATE: Aug'06	DRAWN BY: GJD		



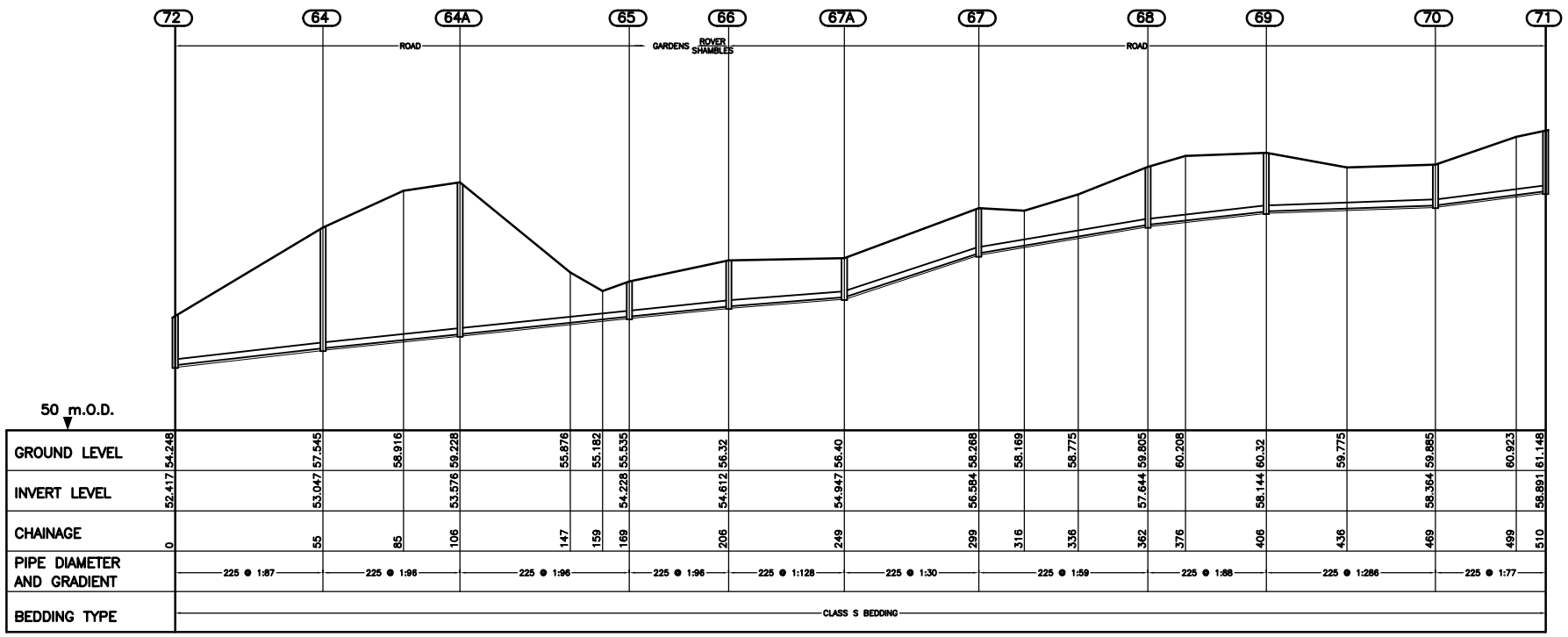
8 – EXISTING FOUL SEWER – CANAL STREET TO DUBLIN ROAD



9 – EXISTING FOUL SEWER – CHURCH SQUARE TO GLASSLOUGH STREET



10 – EXISTING FOUL SEWER – MARKET STREET TO HIGH STREET



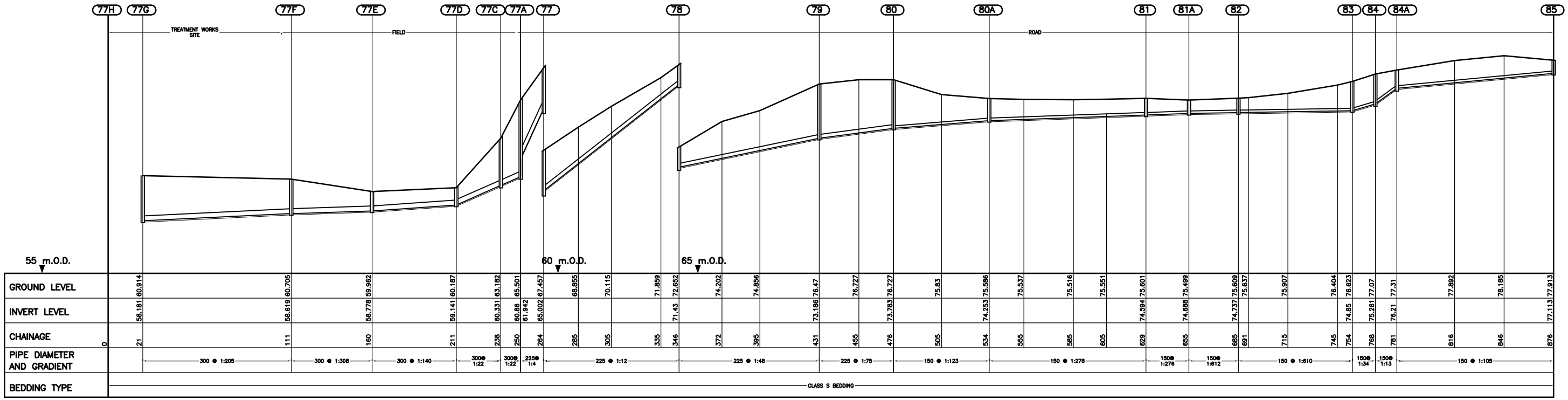
11 – EXISTING FOUL SEWER – CASTLEBLANEY ROAD – DUBLIN STREET

	UPDATED PRELIMINARY REPORT ISSUE	MAR'07
	AMENDMENT DETAILS	DATE

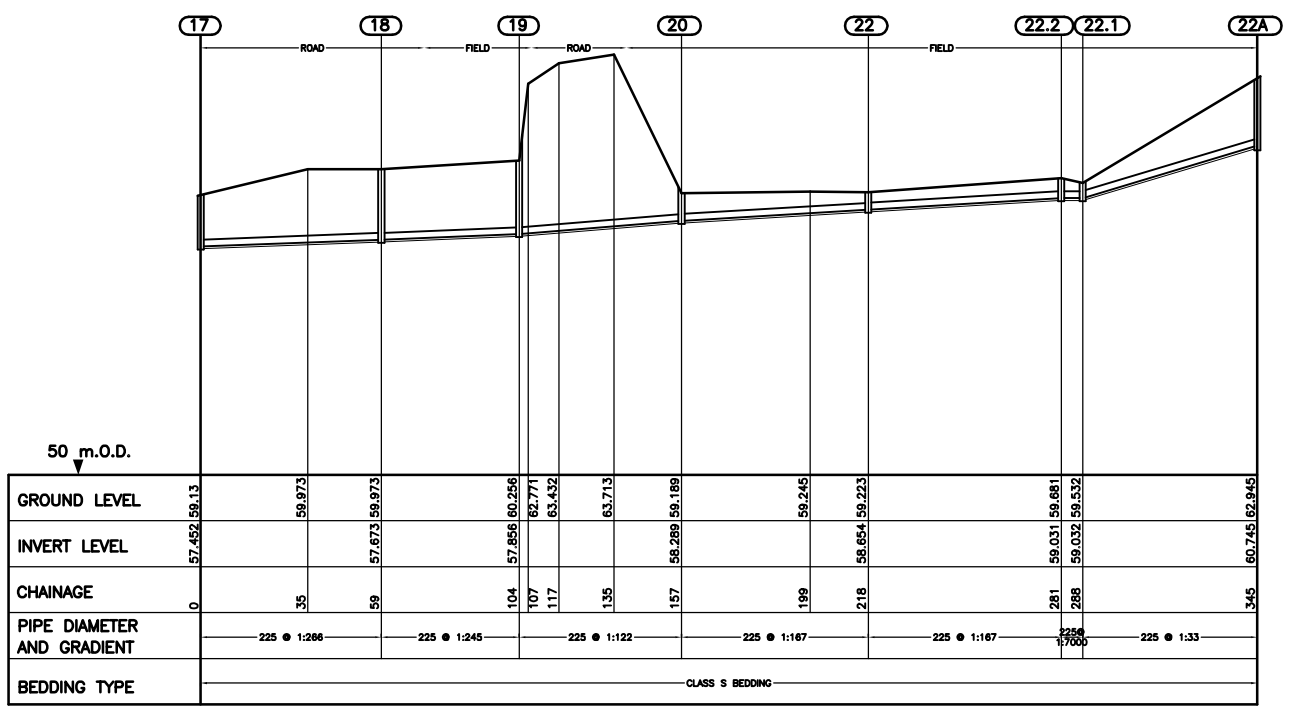
T.J.O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 295 2321 Fax: 295 4541

PROJECT: MONAGHAN TOWN COLLECTION NETWORK
CLIENT: MONAGHAN COUNTY COUNCIL
DRAWING TITLE: EXISTING FOUL SECTIONS – SHEET 5 OF 7

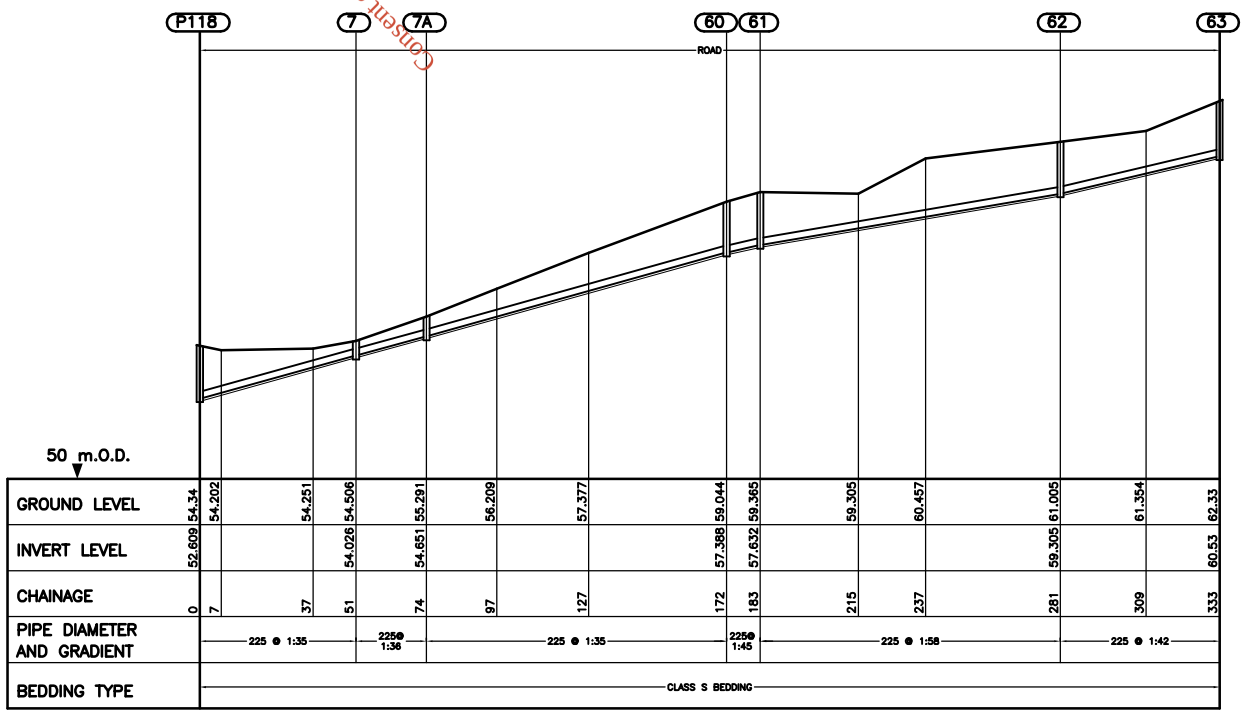
SCALE: 1:1250h, 1:125v	JOB NO: 6322	DRAWING NO: 100
DATE: Aug'06	DRAWN BY: GJD	



4 – EXISTING FOUL SEWER – TREATMENT WORKS TO DUBLIN ROAD TO OLD ARMAGH ROAD



6 – EXISTING FOUL SEWER – PLANTATION ROAD TO SPORTS GROUND



7 – EXISTING FOUL SEWER – MARKET ROAD TO PARK STREET

	UPDATED PRELIMINARY REPORT ISSUE	MAR'07
	AMENDMENT DETAILS	DATE

T.J.O'CONNOR & ASSOCIATES
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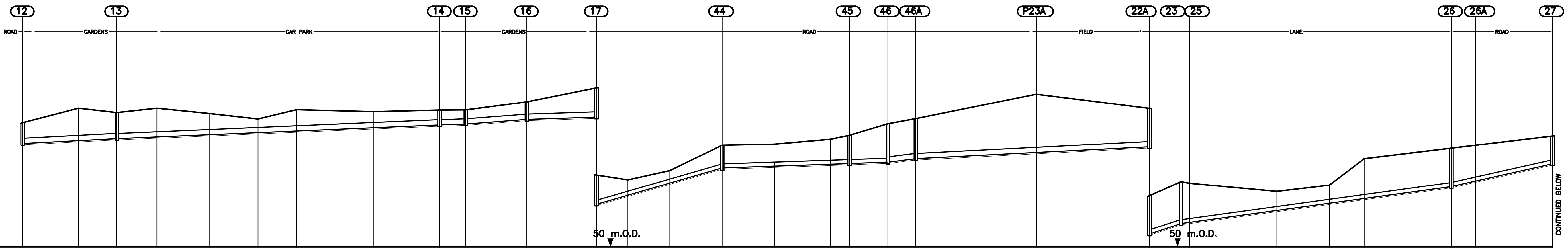
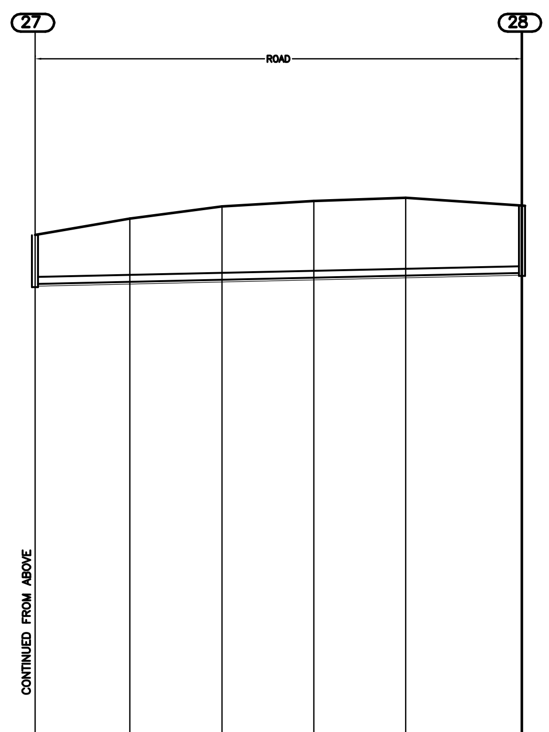
PROJECT: MONAGHAN TOWN COLLECTION NETWORK
CLIENT: MONAGHAN COUNTY COUNCIL
DRAWING TITLE: EXISTING FOUL SECTIONS – SHEET 4 OF 7
SCALE: 1:1250h, 1:125v | JOB NO: 6322 | DRAWING NO: 99
DATE: Aug'06 | DRAWN BY: GJD



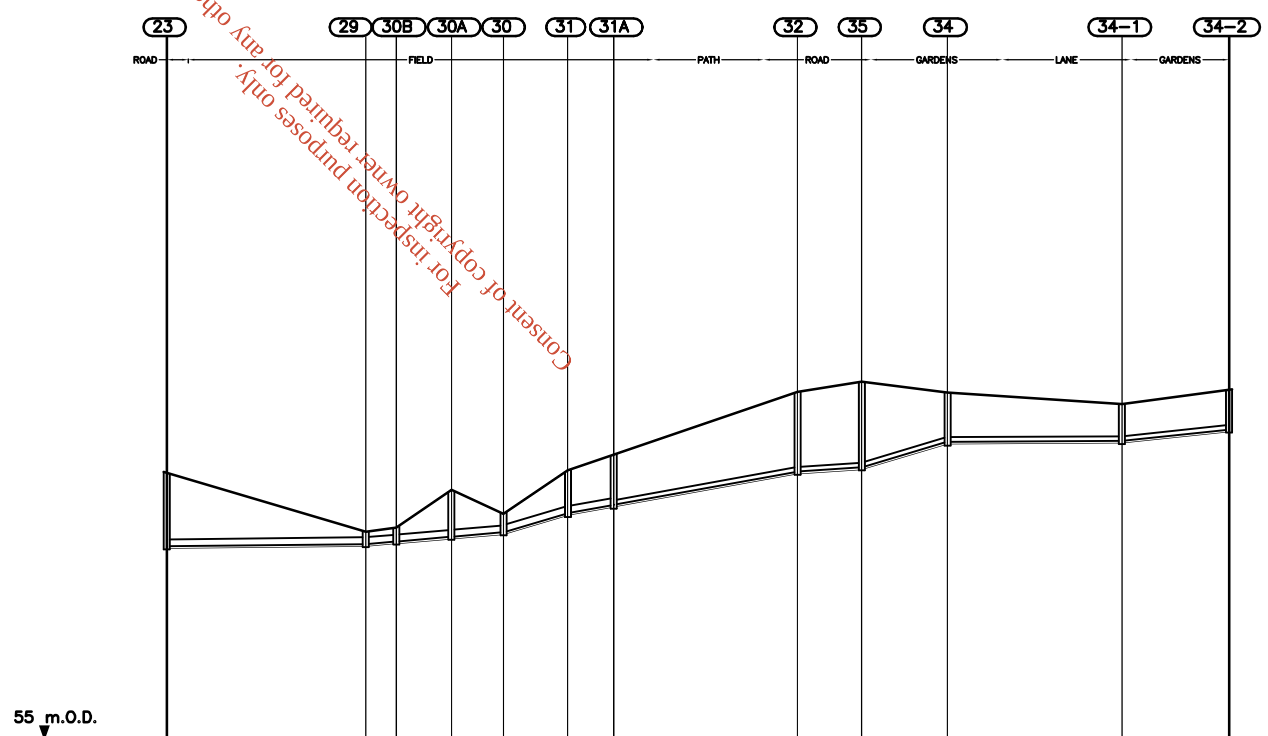
Chainage	Ground Level	Invert Level	Pipe Diameter and Gradient	Bedding Type
0	57.125	55.937	300 ● 1:194	CLASS S BEDDING
32	57.958			
54	57.708	56.215	300 ● 1:236	
77	57.958			
107	57.657			
135	57.345			
157	57.869			
201	57.754			
239	57.854	56.998	300● 1:258	
254	57.867	57.056	300 ● 1:133	
289	58.318	57.318	300 ● 1:298	
329	59.13	57.452	225 ● 1:34	
347	58.848			
371	59.378			
401	60.837	59.537	225 ● 1:290	
431	60.90			
463	61.181			
474	61.407	59.788	225● 1:289	
496	62.064	59.864	300● 1:79	
512	62.362	60.064	300 ● 1:196	
581	63.762			
646	62.945	60.745	225● 1:29	
664	63.746	61.346	225 ● 1:72	
669	63.648			
719	63.192			
749	63.551			
769	65.06			
819	65.671	63.471	225 ● 1:44	
833				
877	66.371	64.771		

3 – EXISTING FOUL SEWER – NORTH ROAD TO PLANTATION ROAD TO GLASSLOUGH ROAD TO STANLEY TERRACE



Chainage	Ground Level	Invert Level	Pipe Diameter and Gradient	Bedding Type
877	66.371	64.771	225 ● 1:442	CLASS S BEDDING
908	66.904			
938	67.299			
968	67.484			
998	67.586			
1036	67.33	65.13		

3 – EXISTING FOUL SEWER – NORTH ROAD TO PLANTATION ROAD TO GLASSLOUGH ROAD TO STANLEY TERRACE



Chainage	Ground Level	Invert Level	Pipe Diameter and Gradient	Bedding Type
0	63.748	61.346	225 ● 1:928	CLASS S BEDDING
65	61.816	61.416	225● 1:116	
75	61.959	61.502	225● 1:116	
93	63.186	61.657	225● 1:116	
110	62.403	61.803	225● 1:33	
131	63.829	62.429	225● 1:55	
146	64.34	62.70	150 ● 1:55	
206	66.384	63.784	150● 1:149	
227	66.724	63.924	150● 1:33	
255	66.361	64.761	150 ● 1:2279	
312	65.986	64.786	150 ● 1:94	
347	66.455	65.155		

5 – EXISTING FOUL SEWER – SPORTS GROUNDS TO BELGIUM PARK

	UPDATED PRELIMINARY REPORT ISSUE	MAR'07
	AMENDMENT DETAILS	DATE

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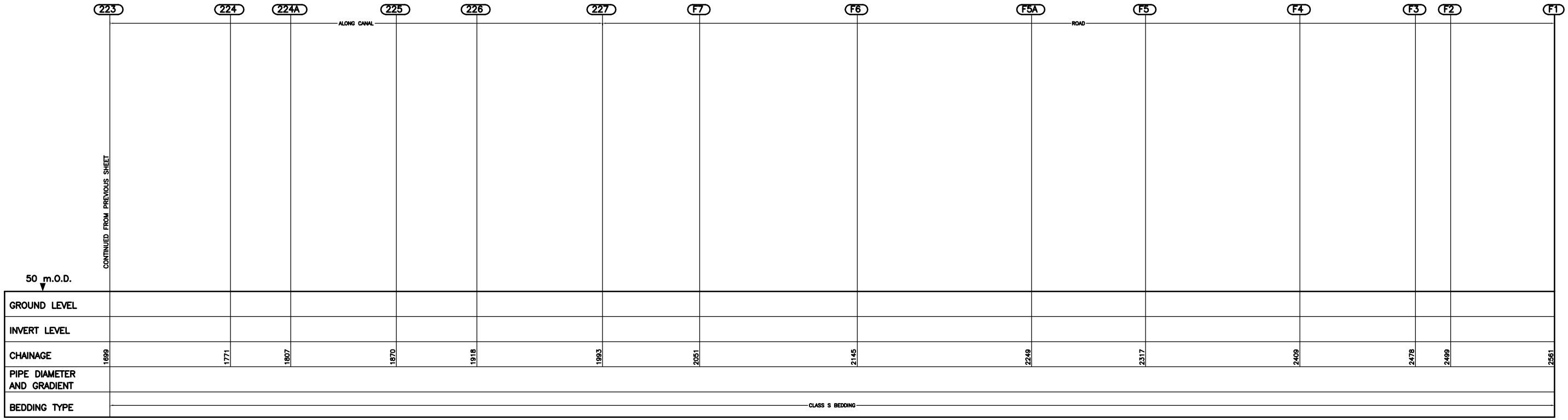
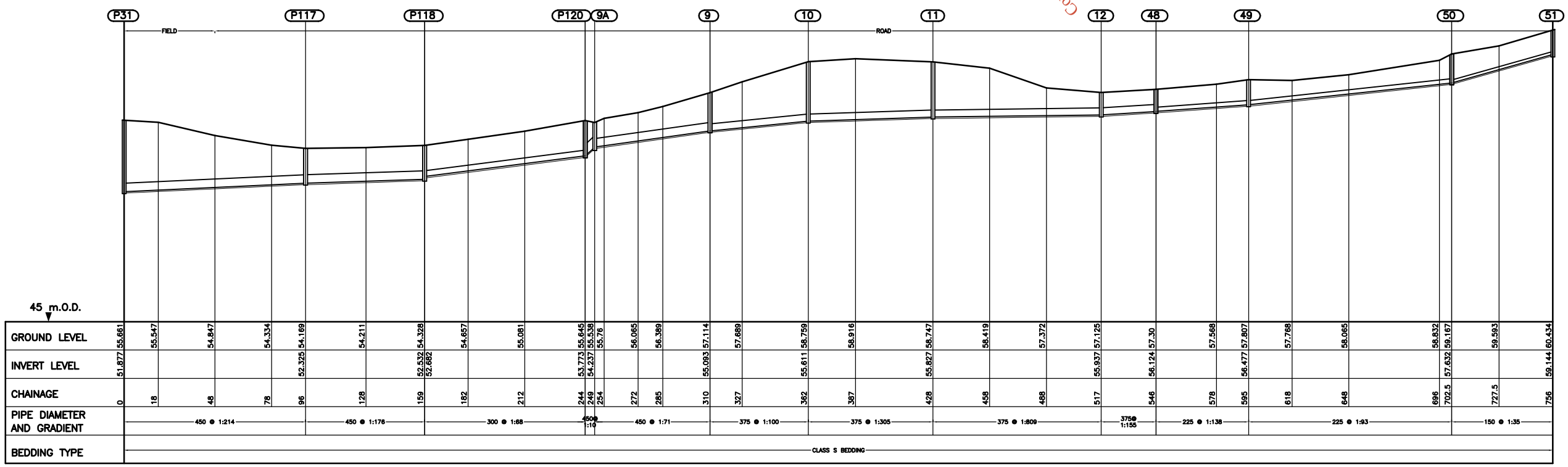
PROJECT: MONAGHAN TOWN COLLECTION NETWORK
CLIENT: MONAGHAN COUNTY COUNCIL
DRAWING TITLE: EXISTING FOUL SECTIONS – SHEET 3 OF 7
SCALE: 1:1250h, 1:125v
JOB NO: 6322
DRAWING NO: 98
DATE: Aug'06
DRAWN BY: GJD

Drawing name: GJD :– D:\Drawings\2633 Monaghan town collection network\tjoc drawings\tender dec 2007\2633 96–102 existing sections.dwg/98 Dec 13,2007 1:48pm



1 – EXISTING FOUL SEWER – OLD CROSS PUMPING STATION TO DAWSON STREET ALONG CANAL TO GLEN ROAD



2 – EXISTING FOUL SEWER – DAWSON STREET TO NORTH ROAD

	UPDATED PRELIMINARY REPORT ISSUE	MAR'07
	AMENDMENT DETAILS	DATE

T.J.O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
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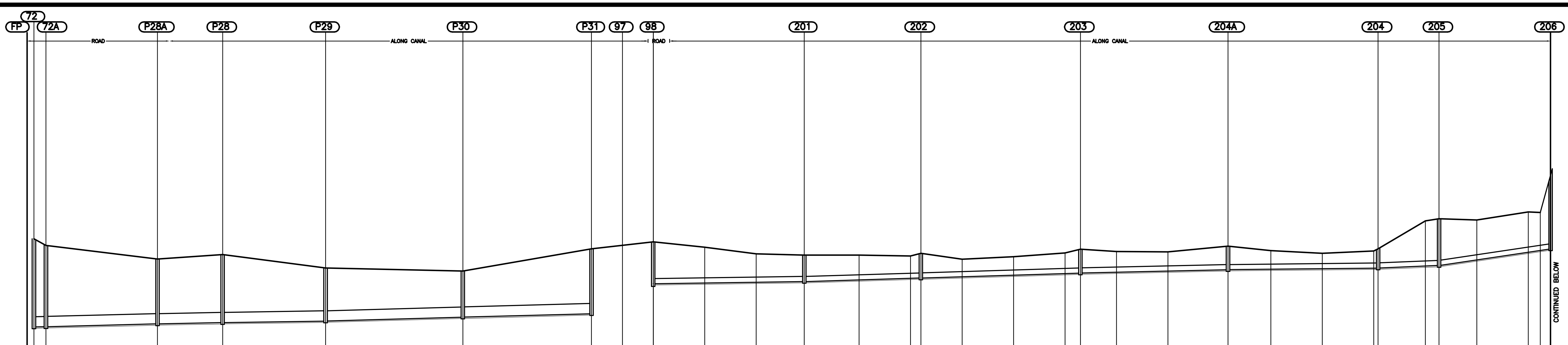
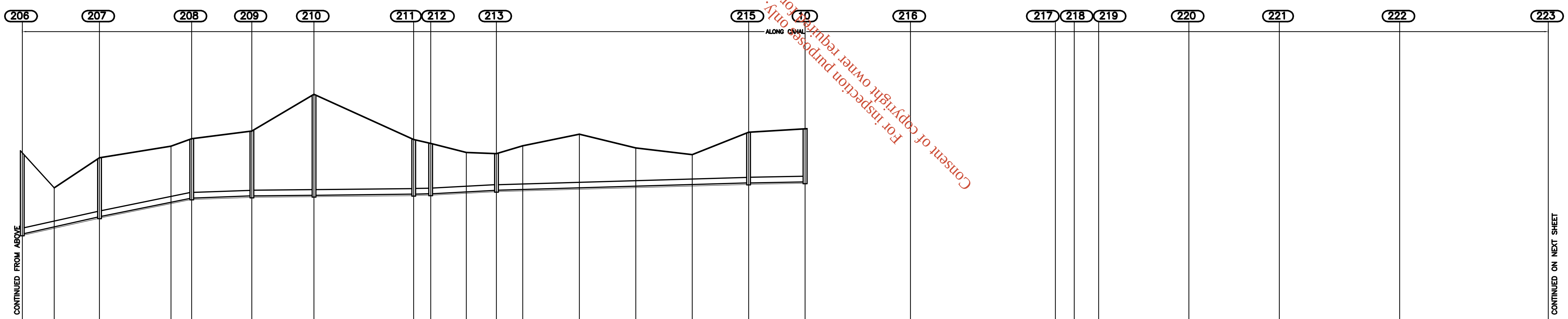
PROJECT: MONAGHAN TOWN COLLECTION NETWORK
CLIENT: MONAGHAN COUNTY COUNCIL
DRAWING TITLE: EXISTING FOUL SECTIONS – SHEET 2 OF 7

SCALE: 1:1250h, 1:125v	JOB NO: 6322	DRAWING NO: 97
DATE: Aug'06	DRAWN BY: GJD	



CHAINAGE	INVERT LEVEL	GROUND LEVEL	PIPE DIAMETER AND GRADIENT	BEDDING TYPE
0	51.000		600Ø 1:41	CLASS S BEDDING
4	51.103	56.248		
11	51.12	55.866	600 @ 1:393	
76	51.285	55.065	600 @ 1:520	
114	51.358	55.328	600 @ 1:659	
174	51.449	54.549	600 @ 1:350	
254	51.677	54.372	600 @ 1:374	
329	51.877	55.661		
347				
365	53.627	56.077	300 @ 1:687	
395		55.761		
425		55.376		
453	53.755	55.305	300 @ 1:328	
485		55.301		
515		55.25		
521	53.962	55.406	300 @ 1:320	
545		55.06		
575		55.206		
605		55.428		
614	54.252	55.645	300 @ 1:434	
635		55.507		
665		55.485		
700	54.45	55.821	300 @ 1:961	
725		55.566		
755		55.407		
785		55.539		
787.5	54.541	55.665	300 @ 1:232	
815		57.297		
823	54.694	57.417	300 @ 1:67	
845		57.346		
875		57.815		
882		57.784		
888	55.657	59.972		

1 – EXISTING FOUL SEWER – OLD CROSS PUMPING STATION TO DAWSON STREET ALONG CANAL TO GLEN ROAD



CHAINAGE	INVERT LEVEL	GROUND LEVEL	PIPE DIAMETER AND GRADIENT	BEDDING TYPE
888	55.657	59.972	300 @ 1:44	CLASS S BEDDING
905		58.113		
929	56.571	59.708	300 @ 1:49	
967		60.322		
978	57.568	60.718	300Ø 1:283	
1010	57.681	61.132	300 @ 1:942	
1043	57.716	63.084	300 @ 1:946	
1096	57.772	60.68	300Ø 1:374	
1105	57.798	60.471	300 @ 1:191	
1124		59.991		
1140	57.979	59.932	300 @ 1:342	
1154		60.342		
1184		60.964		
1214		60.235		
1244		59.881		
1274	58.37	61.07	300Ø 1:499	
1304	58.43	61.253		
1360				
1437				
1447				
1460				
1508				
1556				
1620				
1699				

1 – EXISTING FOUL SEWER – OLD CROSS PUMPING STATION TO DAWSON STREET ALONG CANAL TO GLEN ROAD

AMENDMENT DETAILS	DATE
UPDATED PRELIMINARY REPORT ISSUE	MAR'07

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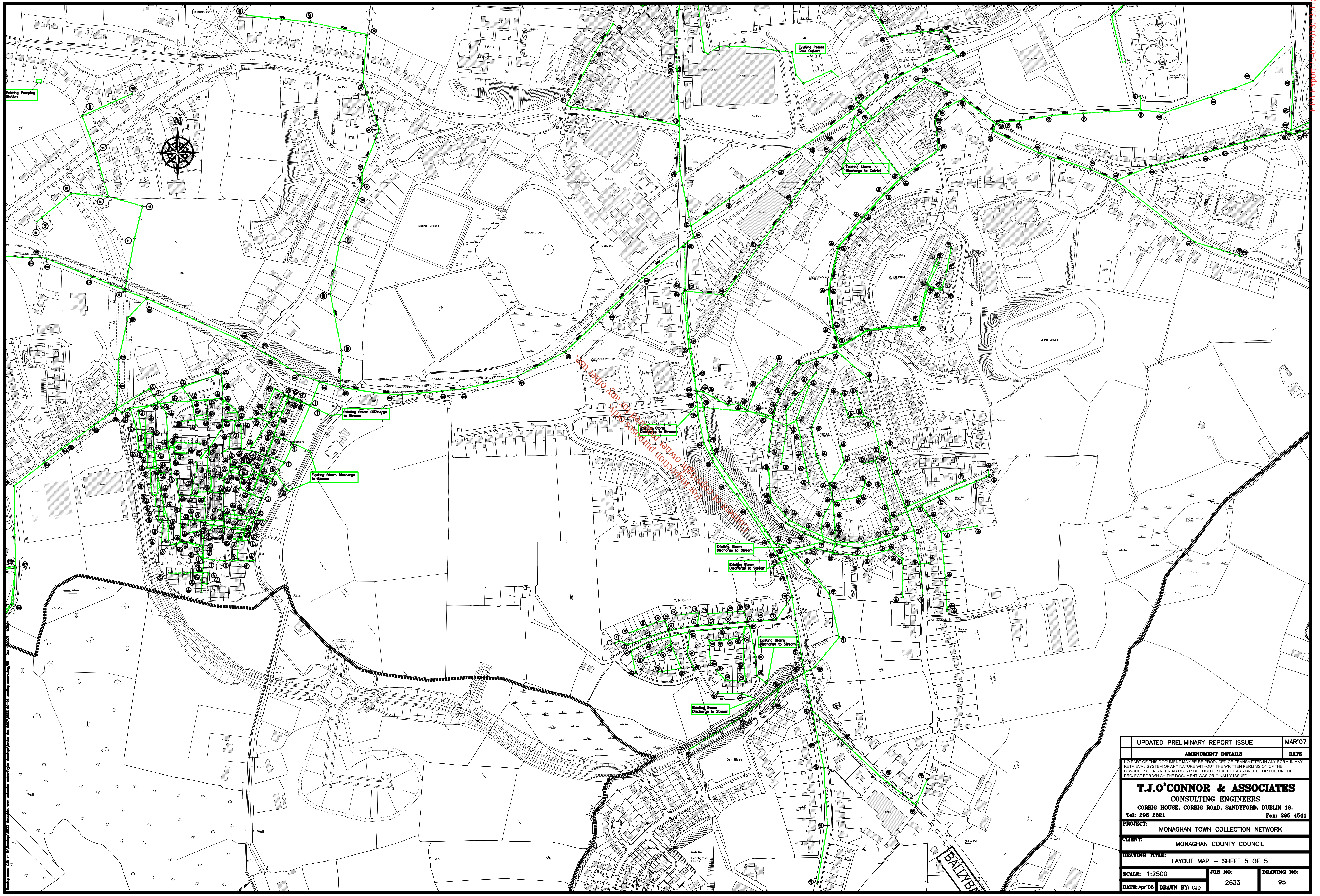
PROJECT: MONAGHAN TOWN COLLECTION NETWORK
CLIENT: MONAGHAN COUNTY COUNCIL
DRAWING TITLE: EXISTING FOUL SECTIONS – SHEET 1 OF 7
SCALE: 1:1250h, 1:125v
JOB NO: 6322
DRAWING NO: 96
DATE: Aug'06
DRAWN BY: GJD



UPDATED PRELIMINARY REPORT ISSUE	MAR'07
AMENDMENT DETAILS	**DATE**

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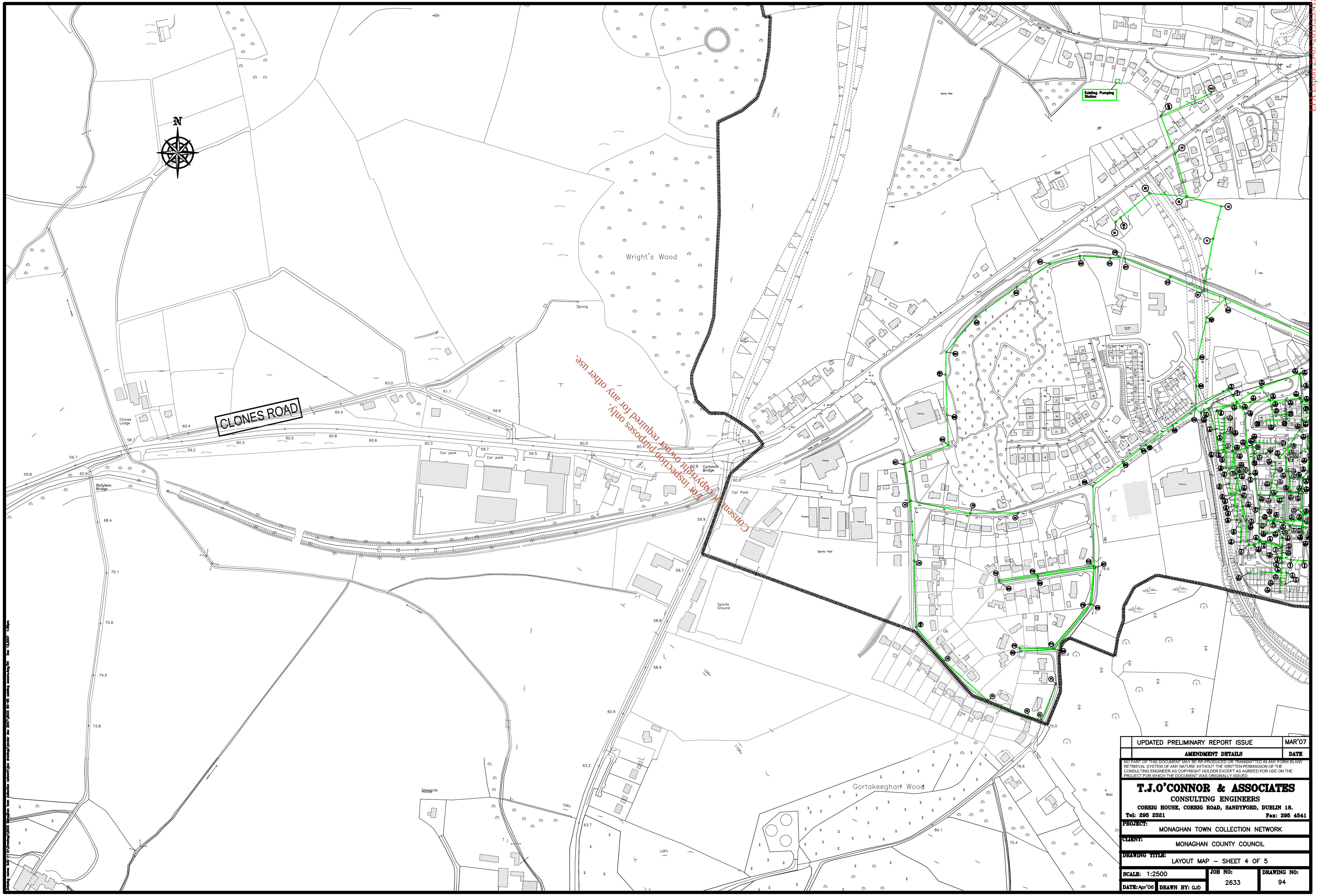
PROJECT: MONAGHAN TOWN COLLECTION NETWORK

CLIENT: MONAGHAN COUNTY COUNCIL

DRAWING TITLE: LAYOUT MAP – SHEET 5 OF 5

SCALE: 1:2500	JOB NO: 2633	DRAWING NO: 95
DATE: Apr'06 DRAWN BY: GJD		



UPDATED PRELIMINARY REPORT ISSUE	MAR'07
AMENDMENT DETAILS	**DATE**

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Tel: 295 2321 Fax: 295 4541

PROJECT: MONAGHAN TOWN COLLECTION NETWORK

CLIENT: MONAGHAN COUNTY COUNCIL

DRAWING TITLE: LAYOUT MAP – SHEET 4 OF 5

SCALE: 1:2500	JOB NO: 2633	DRAWING NO: 94
DATE: Apr'06 / DRAWN BY: GJD		

UPDATED PRELIMINARY REPORT ISSUE	MAR'07
AMENDMENT DETAILS	DATE

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CONSULTING ENGINEERS
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Tel: 295 2321 Fax: 295 4541

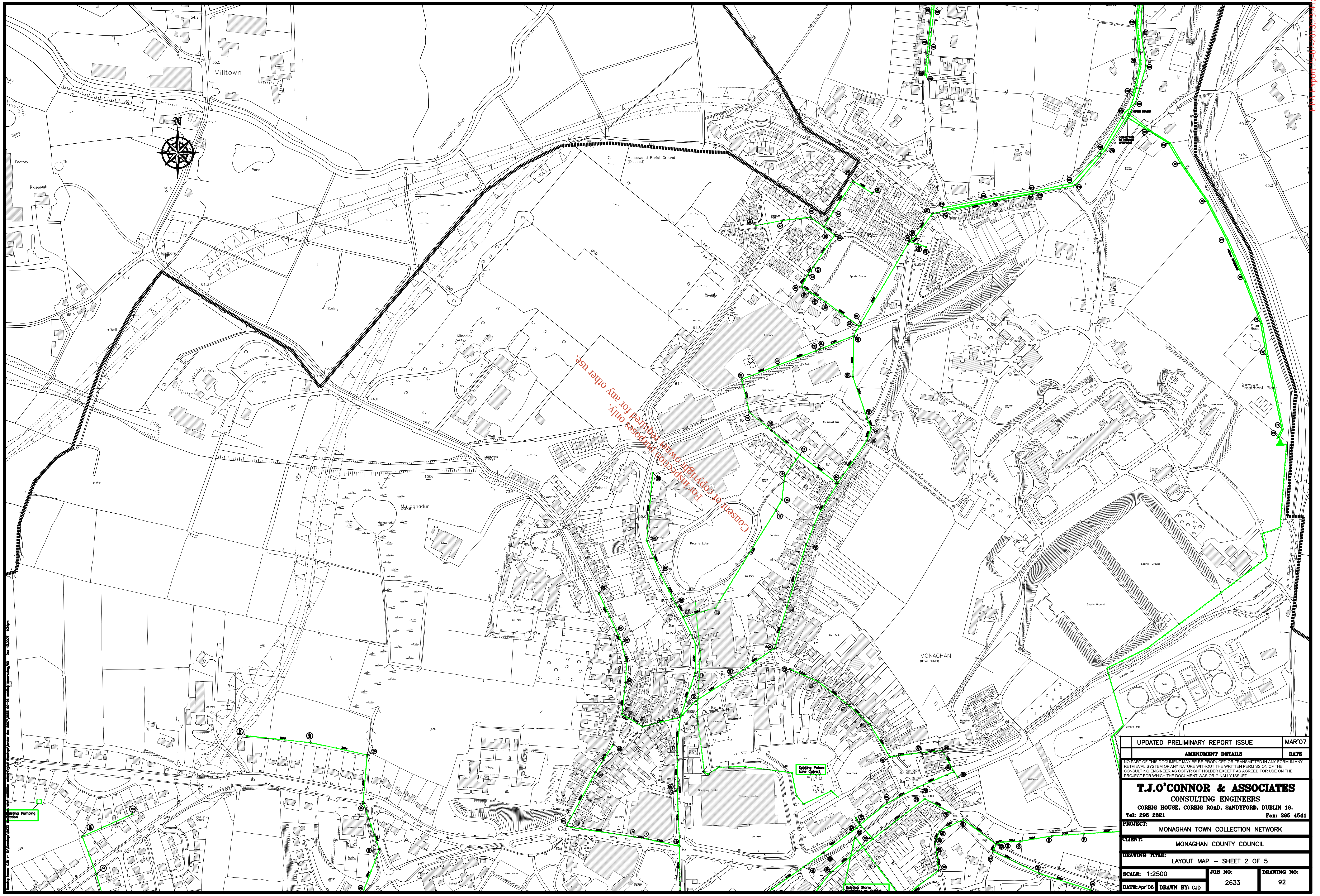
PROJECT: MONAGHAN TOWN COLLECTION NETWORK

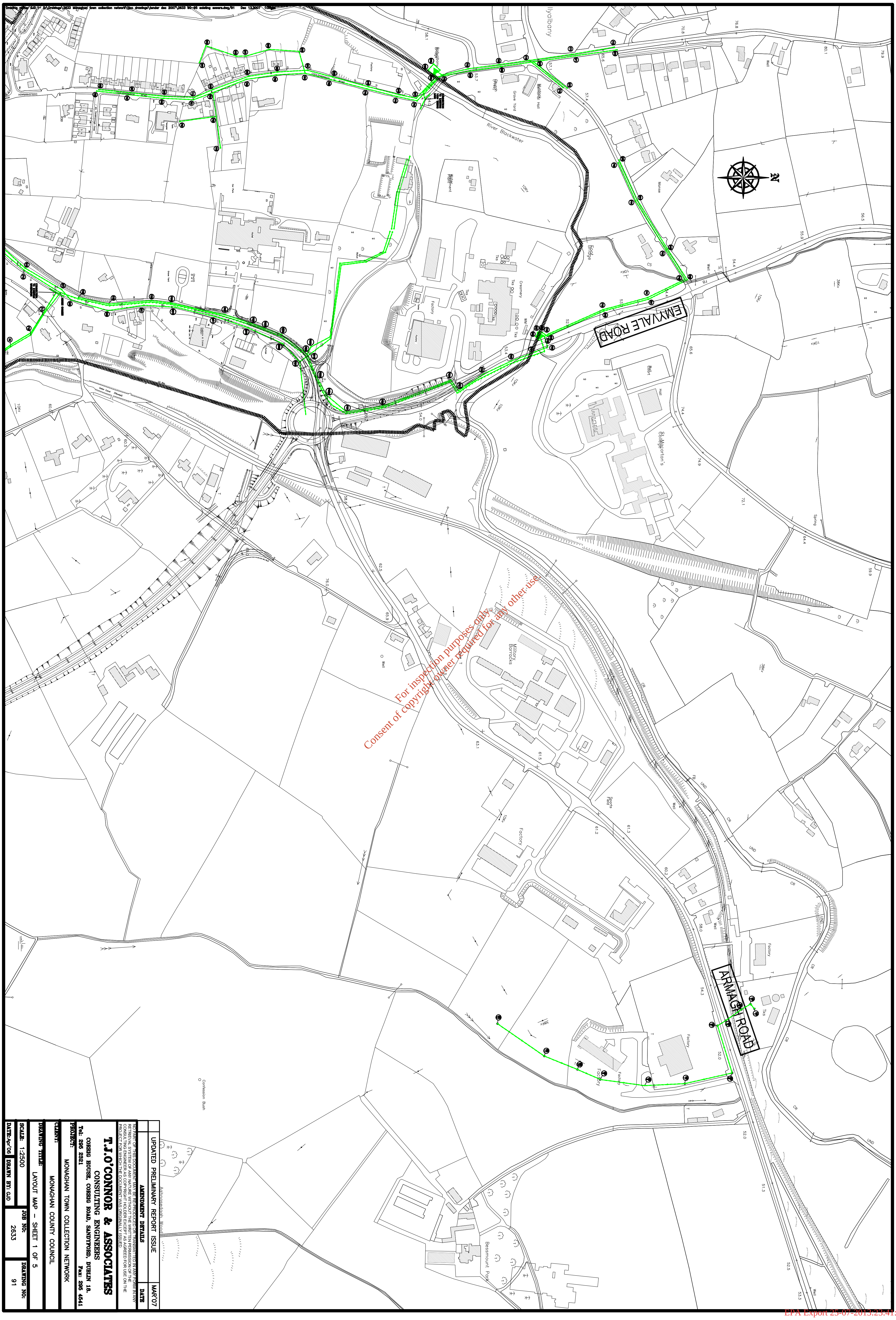
CLIENT: MONAGHAN COUNTY COUNCIL

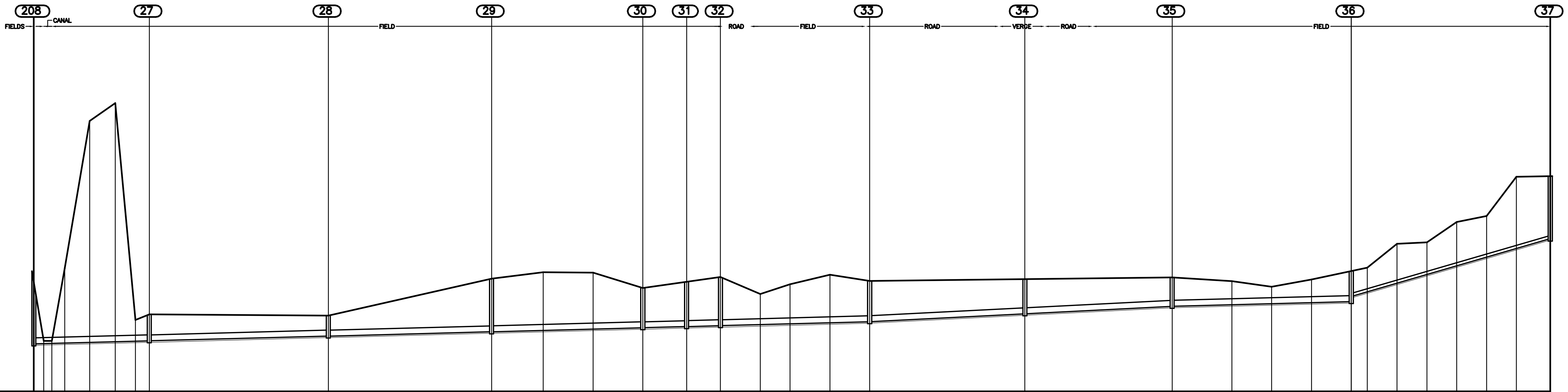
DRAWING TITLE: LAYOUT MAP – SHEET 3 OF 5

SCALE: 1:2500 | **JOB NO:** 2633 | **DRAWING NO:** 93

DATE: Apr'06 | **DRAWN BY:** GJD







CHAINAGE	GROUND LEVEL	INVERT LEVEL
0	60.463	57.384
5	57.537	
9	57.537	
15.5	61.189	
28.1	68.612	
40.9	69.508	
51	58.587	
58	58.872	57.538
148	58.805	57.777
230	60.673	57.995
256	60.996	
281	60.978	
306	60.198	58.197
328		58.256
345	60.758	58.301
365	59.893	
380	60.387	
400	60.865	
420	60.56	58.50
498		58.90
572	60.736	59.28
602	60.546	
622	60.266	
642	60.626	
662		59.516
670	61.226	59.777
685	62.426	
700	62.496	
715	63.526	
730	63.826	
745	65.806	
762	65.831	62.685

Section	PIPE DIAMETER AND GRADIENT
208 – 27	300 Ø 1:376
27 – 28	300 Ø 1:376
28 – 29	300 Ø 1:376
29 – 30	300 Ø 1:376
30 – 31	300Ø 1:372
31 – 32	300Ø 1:377
32 – 33	300 Ø 1:376
33 – 34	300 Ø 1:195
34 – 35	300 Ø 1:194
35 – 36	300 Ø 1:381
36 – 37	150 Ø 1:34

BEDDING TYPE: CLASS S BEDDING

15 – EXISTING FOUL SEWER – ALONG CANAL TO CLONES ROAD

	AMENDMENT DETAILS	DATE
	UPDATED PRELIMINARY REPORT ISSUE	MAR'07

T.J.O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
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PROJECT: MONAGHAN TOWN COLLECTION NETWORK
CLIENT: MONAGHAN COUNTY COUNCIL
DRAWING TITLE: EXISTING FOUL SECTIONS – SHEET 7 OF 7
SCALE: 1:1250h, 1:125v
JOB NO: 6322
DRAWING NO: 102
DATE: Aug'06
DRAWN BY: GJD